

Connecting Innovators, Making Pro-Poor Solutions Work

The Innovation System
of African Leafy Vegetables in Kenya

Seminar für Ländliche Entwicklung | Centre for Rural Development

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SLE Postgraduate Studies on International Cooperation

PUBLICATION SERIES S 260

Study commissioned by HORTINLEA Project

Horticultural Innovation and Learning for Improved Livelihoods in East Africa

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Berlin, June 2015

Supported by



Federal Ministry
of Education
and Research



Federal Ministry
for Economic Cooperation
and Development

Senate Department
for Economics, Technology
and Research


HORTINLEA
DIVERSIFYING FOOD SYSTEMS

be  **Berlin**

SLE PUBLICATION SERIES S 260

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Print	Zerbe Druck&Werbung Planckstr. 11 16537 Grünheide Germany
Distribution	SLE Hessische Str. 1-2 10115 Berlin Germany
Photos	Malin Elsen Luca Gefäller Jerono Emmy AVRDV Bikablo
Copyright	2015 by SLE 1 st Edition 2015 (1-200) ISSN 1433-4585 ISBN 3-936602-65-4

Foreword

For 52 years, the Centre for Rural Development (SLE - Seminar für Ländliche Entwicklung), Humboldt Universität zu Berlin, has trained young professionals in the field of German and international development cooperation.

Three-month practical projects conducted on behalf of German and international organisations in development cooperation form an integral part of the one-year postgraduate course. In interdisciplinary teams and with the guidance of experienced team leaders, young professionals carry out assignments on innovative future-oriented topics, providing consultant support to the commissioning organisations. Involving a diverse range of actors in the process is of great importance, which entails conducting surveys from the household level all the way to decision makers and experts at the national level. The outputs of this “applied research” directly contribute to solving specific development problems.

The studies are mostly linked to rural development (including management of natural resources, climate change, food security or agriculture), cooperation with fragile or least developed countries (including disaster prevention, peace building, and relief) or the development of methods (evaluation, impact analysis, participatory planning, process consulting and support).

Throughout the years, SLE has carried out over two hundred consulting projects in more than ninety countries, and regularly publishes the results in this series. In 2014, SLE teams completed studies in Kenya, the SADC region, Paraguay, Cambodia and Tajikistan.

The present study was commissioned by the HORTINLEA Project (Horticultural Innovation and Learning for Improved Livelihoods in East Africa) within the framework of Global Food Security (GlobE), a funding initiative of the German Federal Ministry of Education and Research (BMBF) and the Federal Ministry for Economic Cooperation and Development (BMZ), in co-operation with Jomo Kenyatta University of Agriculture and Technology.

Prof. Dr. Uwe Schmidt
Director of the Albrecht Daniel-Thaer Institute
Humboldt Universität zu Berlin

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Rural Development / SLE

Acknowledgements

First and foremost we would like to express our thanks to the HORTINLEA project, funded through the German Federal Ministry of Education and Research (BMBF) and the Federal Ministry for Economic Cooperation and Development (BMZ). In particular, we would like to thank Prof. Wolfgang Bokelmann and Mr. Zoltan Ferenczi, the Director and the Coordinator of HORTINLEA project respectively, for their excellent support and contribution to this study. We are also very grateful to all HORTINLEA scientists at their respective universities and research centres who provided detailed information on their project work and helped the study team to establish contacts with interview partners.

In Kenya, we would like to express our sincere gratitude to Prof. Esther Kahangi, Deputy Vice Chancellor of JKUAT, for her valuable advice and support. We are also very grateful to Prof. Mary Abukutsa-Onyango, from JKUAT for her support and for the unique friendship with the SLE team. Our thanks also go to the entire JKUAT and AICAD staff, providing us with office space, equipment and logistical support in central Kenya.

We would like to give special thanks to Dr. Lusike Wasilwa, Manager for Horticulture and Industrial Crops in KALRO, Dr. Charles Waturu Nderito, Director of Horticulture Crops Research Institute, KALRO and to the entire KALRO staff for sharing their contacts and supporting our field work with logistics and organisation. Special thanks in this regard go to Dr. Christine Ndinya-Omboko, from KALRO-Kakamega, who helped us to arrange the field visits as well as discussions with farmers and local experts in Western Kenya.

The study would not have been possible without the support and patience of Kenyan farmers, as well as representatives from local and national government, research and education organisations, NGOs, and the private sector, as well as extension officers, nutrition specialists and other local and international experts. We are therefore grateful to all these actors for their interest and support in participating in interviews and discussions and by providing contacts and valuable information on ALVs sub-sector in Kenya. We would also like to thank all the persons who served as facilitators or translators, who supported the field work of the study in numerous communities and who hosted us and ensured our well-being in Kenya.

Last but not least we would like to express our thanks to the entire SLE staff, especially Ms. Anja Kühn, for their valuable advice, feedback and support in preparing and implementing this study.

Executive Summary

Study Context

Kenya is the strongest economy in the East African region and derives a large share of its income from agriculture. Despite this, a large proportion of the Kenyan population is affected by hunger and particularly by chronic malnutrition associated with lack of essential micronutrients, known as hidden hunger. An important group among them is smallholder farmers living in poverty stricken regions.

African Leafy Vegetables (ALVs) can be an important element of a wholesome diet and thus hold the potential to alleviate hidden hunger, as well as to contribute to income generation for smallholder farmers often affected by poverty. However, the national demand for ALVs is currently not met by producers, who encounter many different problems. Innovations can solve problems along the value chain of ALVs, and agricultural research can make a decisive contribution to solutions. To find sustainable solutions, value chain actors, researchers and policy-makers need to work together. In the past, however, there have been gaps between actors involved in agricultural innovation, leading to unused potentials.

The Kenyan-German research project HORTINLEA (Horticultural Learning for Improved Livelihood and Nutrition in East Africa), funded by the German Federal Ministry for Education and Research, and the Ministry for Economic Cooperation and Development, focuses on individual studies on aspects of the ALV value chain over a 5-year period and seeks to contribute to reducing hidden hunger and alleviating extreme poverty. In order to ensure practical relevance, HORTINLEA commissioned this study to assess the innovation system of ALVs and to identify new collaboration partners for active knowledge exchange promoting pro-poor ALV production processes and enabling the transfer and application of research results into practice.

The study includes (1) an adaptation of the innovation systems perspective to the context of ALVs in Kenya, (2) a comprehensive assessment of the innovation ecology for ALVs and (3) conclusions and recommendations. The study concludes with an application of the innovation system perspective through an exemplary analysis of the innovation system for seed supply, based on primary research in Kenya.

Theoretical Framework and Methodology

As a theoretical framework the study adopts the innovation systems perspective. Following an evolution of approaches to agricultural research for development which have mostly failed to effectively connect research and practice, this perspective attempts to learn from past mistakes. To this end, it takes a comprehensive view of farmers, researchers, policymakers and other actors whose interactions can lead to successful innovation. Innovation is defined here as a process that encompasses the components of generation, dissemination, adaptation and adoption of new knowledge or putting to use (adopting) existing knowledge in a new context. Successful innovation depends on the overall context of the economic sector (markets, policies, infrastructure etc.), the capacities of all actors involved (financial and human resources etc.) and their effective interactions (exchange of knowledge and other resources, power relations etc.). Taken together, these factors form the innovation ecology of a given economic sector.

Adapting the innovation systems perspective to the context of ALVs in Kenya, the study identified a range of actors whose effective collaboration is relevant to increased horticultural production through innovation. The study clusters the actors in six groups, including the policy arena, research systems, education actors, the intervention landscape, linking (or intermediary) actors and value chain actors, including farmers. Innovation system actors can be individuals or organisations, the defining feature is their role or function with regard to innovation processes. Small-scale farmers are given a special focus because they also form part of HORTINLEA's target group, i.e. populations affected by poverty and hidden hunger.

Centring on the actor groups, the study analysed the conditions they face in carrying out their functions with regard to innovation in the ALV sub-sector. The study highlights determinants for successful innovation, i.e. positive as well as negative factors linked to the political and infrastructural context, the actors' capacities and their interactions.

In generating primary data, the research team took a qualitative approach. 44 individuals from policy, research and development practice were interviewed using a semi-structured questionnaire. 11 groups of farmers in locations in Western Kenya (Kakamega County) as well as central Kenya (Kiambu and Nairobi Counties) were interviewed and encouraged to engage in discussion. Three stakeholder meetings were held with different stakeholders (mainly researchers). Two Focus Group Discussions were conducted with extension workers and government nutritionists, respectively. Empirical results were combined with secondary sources and existing agricultural policies.

Main Findings

Institutional framework and context factors: In assessing the general context for innovation in the small-scale ALV sub-sector, the study focuses on relevant agricultural policies, infrastructure and general access to resources necessary for innovation. The study finds that there is currently no clear focus in Kenyan agricultural policies on using the potentials of small-scale horticulture to combat hidden hunger. Stressing innovation and entrepreneurship, the main thrust of policies relevant to horticulture is aimed at export-oriented high-value crops such as cut flowers. Another important political factor affecting ALV innovations is the ongoing devolution process in Kenya. The implementation of agricultural policy was made the responsibility of the 47 newly-created county governments, while the national government retains the responsibility for formulating policies. This means that while the counties have some space to set their own priorities, e.g. to promote ALV production through support to innovative farmers, the national level defines that space.

With regard to infrastructure, the study identifies the conditions of Kenya's transportation and communication infrastructure as a hindrance both to inclusive market access for farmers and to the dissemination of new technologies. The highly unequal distribution of agricultural land that is especially disadvantageous for women and young farmers narrows the space for innovation processes, as few farmers have the chance to experiment on their own land. Equally, access to financial resources is identified as a limiting factor for innovation, both for farmers and for researchers.

The overall economic conditions for innovation in the Kenyan ALV sub-sector are good, as there is a high and/or rising demand for the vegetables. However, the study finds demand to be different across the regions analysed. In Western Kenya, where ALVs have always been a part of traditional diets and where many farmers grow them, the potentials of local markets are not fully met. In central Kenya, fewer farmers grow ALVs and urban markets are more dynamic, as the demand is linked to distinct consumer groups (urban middle class, internal migrants). The level of commercialisation differs accordingly: while subsistence production of ALVs is more prevalent in Western Kenya, those farmers who produce ALVs in central Kenya do so explicitly for commercial purposes. Hence, innovations that aim at supporting the commercialisation of small-scale ALV production have to be adapted to conditions in each location – e.g. providing market access where commercialisation is low and creating more inclusive markets where commercialisation is advanced.

The value chain of ALVs - opportunities for innovation: The study identified a two-dimensional differentiation within the ALV sub-sector that needs to be taken into account, the first being the level of commercialisation of the two value chains and their actors, and the second being regional differences among production sites. Accordingly, it suggests addressing the problems of the ALV innovation ecology separately by value chain and regional differentiation.

Actors: The study analyses the six actor groups - policy arena, research systems, education actors, the intervention landscape, linking or intermediary actors and value chain actors, including farmers - according to their ability to facilitate pro-poor innovation. Criteria in this assessment are (1) the levels of their target group orientation, (2) institutional interests and priorities, (3) capacities, power, human, financial and social resources and (4) challenges and needs.

The assessment of most relevant actors has shown that the public extension service, as well as local NGOs, are key actors for the promotion and support of ALV innovations and an inclusive innovation ecology. They are closest to the farming population and can help ensure their participation in innovation. They act as linking actors between research and implementation. However, their resources are currently insufficient. The mostly defunct public extension service needs a major upscaling of its financial and human resources. Equally close and active in outreach to farmers are the agricultural training centres and colleges, which exist in almost every Kenyan county and train future extension officers. Strengthening their resources and integrating ALVs into their curricula would enable both the extension service and farmers to bring research results into practice.

Other influential ALV-oriented actors are the Kenya Agricultural and Livestock Research Organisation (KALRO) and the county governments. They all fulfil important functions within the innovation ecology but also face some challenges. The universities are the major actor in ALV research and promotion, not only through generating innovations on campus, but also looking for ways in which these can be better adopted by farmers. Their initiatives need to be supported and coordinated by the national research system and the policy level. In this respect, this study predicts that the newly setup KALRO, replacing the Kenya Agricultural Research Institute (KARI), will become the most important national player coordinating and connecting agricultural actors. The County Governments are supporting ALV innovations and pro-poor programmes at the local level. However, the devolution process has so far been lagging and substantial funding has not been received on the county level. County governments therefore face great challenges regarding their financial and human resources.

Farmers are perhaps the most important actor group in the innovation process. They are the active innovators and key to the success of any innovation, as they provide the benchmarks for relevant and demand-driven research and decide on the sustainable adoption of innovations. They are not a homogeneous group, however. This study has established a rough differentiation into two farmer groups according to their level of commercialisation, and further research is necessary to investigate their specific needs and strengths. Subsistence farmers face the greatest challenges in terms of their ability to participate in ALV innovation, especially women and young farmers. Farmers with better access to information, infrastructure and advisory services adopt and advance innovations at a higher level of commercialisation. Differentiated support for the two groups is necessary for successful innovation.

Interactions: With regard to the different ways in which innovation actors interact, the study analyses various channels of information transfer, the relevance and quality of information transferred, transfer of resources, modes of coordination and collaboration, as well as power relations.

The study finds that face-to-face knowledge transfer (i.e. through advice and training) is the most important information transfer channel for farmers. This is because this mode allows for more targeted and comprehensive information packages than the disjointed pieces of information offered by most remote media. They also allow direct feedback and continuous follow-up. In addition, the radio plays a significant role for poorer farmers. This is because radio is affordable, available and understandable to most rural peoples (when in the vernacular). Other media channels that require literacy or have to be paid for can be inaccessible. Concerning the quality of information, the study finds a need for effective knowledge management systems and quality-control of the information transferred. Currently, there are sometimes overlaps and duplications in research. A stronger regulation of the actors involved in dissemination activities is also required, as the curricula of private and non-governmental providers of extension service are currently not monitored. In the provision of financial and other resources for innovation, the study finds that these are currently to a large extent dependent on NGOs and other programmes and that some farmer groups lack access.

The study finds that there are opportunities for innovation in existing collaborations. These include farmer-to-farmer exchanges and farmers' self-help structures as well as those development projects with a coordinated and integrated

approach to research and extension. There are also existing or planned coordinating mechanisms, networks and innovation platforms.

However, many of the aforementioned mechanisms of exchange, as well as the provision of advisory services, depend on the resources available. Therefore, both donor countries and private companies hold a large influence on the design of interventions, as they bring with them the requisite resources. This can lead to programming that is not tailored to the needs of farmers in the Kenyan context and thus hinder rather than advance successful pro-poor innovation.

In conclusion, the study identifies the main bottlenecks for innovation in the Kenyan ALV sub-sector as an unequal access to a range of different resources as well as deficiencies in infrastructure and in the coordination of knowledge exchange.

Conclusions and Recommendations: Based on the assessment of the ALV innovation ecology the study points out opportunities for innovation and gives recommendations for improving aspects of the ecology.

- In order to improve the participation of different actors in ALV innovation processes – including subsistence farmers, women and youth – and to create a more inclusive innovation ecology, the study recommends to address the ALV related structural socio-economic problems on all levels, from national development goals down to local level policies and programmes. At the same time, it identifies a need to shift from well-intentioned policy-making to actual pro-poor programming, taking account of the potentials of ALV production to address food security challenges and targeting also small-scale farmers.
- The problems of the ALV innovation ecology should be addressed separately by value chain and regional differentiation. Moreover, demand-driven research has to assess farmers' needs and incorporate farmers, their indigenous knowledge, solutions and feedback into the entire research process. Farmers are active innovators, key to the success of each step of the innovation cycle, from research to adoption. They need to be strengthened and empowered the most to create a truly inclusive and successful pro-poor innovation ecology.
- Cooperation between innovation ecology actors, including HORTINLEA, and civil society actors should be intensified. The pro-poor target group orientation of civil society actors directly working at the farmer level should be seen as a large networking and collaboration potential. At the same time, the potential of KALRO should be thoroughly explored. Because of its function, human and financial resources, and its adequate geographical spread, KALRO is one of the

best placed Kenyan institutions to promote the application of research findings and innovations on a national and regional scale. To support Kenyan structures sustainably and strengthen the overall agricultural innovation ecology without creating parallel innovation platforms, the planned KALRO College should be considered as an important entry point for actors such as HORTINLEA.

- The study also recommends embedding ALVs into the curricula of the education system. Although the education institutions cover all of Kenya, they only reach a limited number of farmers, due to their lack of human and financial resources.
- The development agencies / donors, the national government and the abundant high-level international research present in Kenya are very influential but seem so far less interested in ALVs. They need to be sensitised, lobbied and incorporated more in order to make use of their capacities.
- While the private sector is viewed by many very critically because of its vested interests and large influence in policy making and programming, some private sector actors nonetheless must be considered potential partners for various tasks within the innovation process, from input supply to disseminating quality information.
- The linking actors (the public extension service, local NGOs and the media) need to be strengthened the most in terms of their financial resources and human capacities in order to close the information-implementation gap between research and farmers. The study recognises that only the inclusion of linking actors will make it possible to implement broadly target-group-oriented, pro-poor strategies working directly with remote and poor farmers, ensuring their participation in innovation processes.
- For a targeted dissemination strategy it is important to choose the right communication channel and language in order to ensure affordability, access and usability for the target groups. Moreover, actors that disseminate knowledge, whether public, NGOs or private, need to be regulated in a transparent way, ensuring that they follow national and local development and policy priorities. Only solutions relevant to and adoptable by (poor) farmers will become successful pro-poor innovations. In order to ensure the right knowledge reaches the right people the shift in research and information transfer must be accompanied by well-coordinated and freely accessible knowledge management systems, and a rigorous quality-control of the knowledge and information transferred.

- Last but not least the study recommends to actors involved in the ALV innovation ecology, such as HORTINLEA and its subprojects, to use the Innovation Systems Perspective to optimise the innovation processes they wish to support and participate in.

The study also highlights identified needs for further research of the innovation ecology or in relation to specific issues regarding ALVs. It suggests that the focus of further research should be on analysing the extent of the generally proposed pro-poor potential of ALVs. Also the factors affecting farmers' willingness or ability to innovate or adapt new solutions, according to their level of commercialisation, need further investigation.

The application of the Innovation System Perspective

By drawing up a “problem-based innovation system”, researchers can identify the relevant context factors, actors and interactions that will condition the implementation of a new solution and determine the success of its final adoption. This tool helps to keep practical implementation in focus throughout the transdisciplinary research process. In addition, having identified the relevant actors for a given innovation, researchers can also act as catalysts of their exchange. Bringing together innovation actors to discuss a problem and share their perspectives can itself foster innovation.

Zusammenfassung

Kenia ist eine der stärksten Volkswirtschaften in Ostafrika. Ein signifikanter Teil der Ökonomie wird aus der landwirtschaftlichen Produktion generiert. Nichtsdestotrotz leidet knapp die Hälfte der Bevölkerung des Landes unter Armut und Hunger, besonders an chronischem Mangel an essentiellen Makro- und Mikronährstoffen. Ärmere kleinbäuerliche Betriebe sind von diesem so genannten *hidden hunger* am stärksten betroffen.

Das große Potential der Indigenen Afrikanischen Blattgemüse (*African Leafy Vegetables* -ALVs) für eine effektive Armutsbekämpfung und als Möglichkeit zur Einkommensgenerierung für kleinbäuerliche Betriebe bleibt noch ungenügend genutzt. Der Anbau dieser Blattgemüse würde sich positiv auf die lokale Wirtschaft auswirken und könnte ein wichtiger Bestandteil einer ausgeglichenen Ernährung für die Menschen in armen Regionen des Landes werden. Jedoch konnte die steigende Nachfrage nach indigenem Blattgemüse von KleinproduzentInnen bisher nicht gedeckt werden. Innovationen können zur Lösung der Probleme entlang der Wertschöpfungskette beitragen und die Agrarforschung könnte somit einen entscheidenden Beitrag für die Suche nach Lösungsansätzen leisten.

Um solche nachhaltigen Lösungsansätze zu konzipieren, müssen alle beteiligten Akteure der Wertschöpfungskette, sowie Forscher und politische Entscheidungsträger eng zusammenarbeiten. Bisher besteht jedoch eine Kluft und eine mangelhafte Kommunikation zwischen diesen Akteuren, was wiederum zu nicht genutzte Potenziale führt.

Im Rahmen des kenianisch-deutschen Forschungsprojekts HORTINLEA werden seit 2013 unterschiedliche Aspekte der Ernährungssicherung entlang der ALV-Wertschöpfungskette erforscht und das Vorhaben soll damit zur Minderung von „verborgenem Hunger“ beitragen. Um größere Praxisrelevanz der Forschungsergebnisse des Projekts zu gewährleisten, hat HORTINLEA diese SLE-Studie in Auftrag gegeben.

Die Studie umfasst: (1) die Anpassung der *Innovation Systems Perspective* für indigene Blattgemüse in Kenia, (2) eine mit empirischen Daten fundierte umfassende Bewertung der erforschten Innovationsökologie der Blattgemüse und (3) Empfehlungen für weitere Verbesserungen der Innovationsprozesse.

Als theoretischer Ansatz der Studie wurde die *Innovation Systems Perspective* ausgewählt. Die Betrachtung der bisherigen Ansätze der Agrarforschung zeigt, dass viele von ihnen bei der Umsetzung scheiterten und das Neu-Erforschte nicht in die Praxis überführt werden konnte. Um das zu vermeiden, berücksichtigt die

Innovation Systems Perspective die Sichtweisen von Bauern, Forschern, politischen Entscheidungsträgern und allen weiteren Akteuren, deren Interaktionen zu erfolgreichen Innovationen führen können. Innovation wird als ein Prozess der Generierung, Verbreitung und Umsetzung von neuen Lösungen bzw. der Nutzung bereits vorhandenen Wissens in einem anderen Kontext gesehen. Die erfolgreiche Umsetzung einer Innovation hängt von der gesamten ökonomischen Lage (Märkte, allgemeine politische Lage, Infrastruktur etc.), von den Kapazitäten der involvierten Akteure (finanzielle, humane, andere Ressourcen etc.) und von einem effektiven Zusammenspiel dieser Akteure (Wissensaustausch und Tausch anderer Ressourcen, politische Zusammenhänge etc.) ab. Die aufgezählten Faktoren bilden gleichzeitig die Ökologie der Innovationen eines bestimmten Wirtschaftssektors.

Bei der Anpassung der *Innovation Systems Perspective* an die Ausgangslage der indigenen Blattgemüse in Kenia identifiziert die Studie eine Reihe von wichtigen Akteuren, deren effektive Zusammenarbeit für die Steigerung der gartenbaulichen Produktion durch Innovationen sehr bedeutsam ist. Die Studie teilt die Akteure in sechs Gruppen ein: die politische Arena, Akteure des Forschungssystems, Bildungsakteure, die Geberlandschaft, Intermediäre oder verlinkende Akteure, sowie Akteure der Wertschöpfungskette, insbesondere die KleinbäuerInnen. Sie können individuell oder als Organisation agieren - entscheidend ist ihre Rolle oder Funktion im Innovationsprozess. Hauptsächlich die KleinbäuerInnen stehen hierbei im Fokus, da sie eine der Zielgruppen des HORTINLEA- Forschungsprojekts sind und von Armut und *hidden hunger* besonders betroffen sind. Die Studie analysiert diese Akteure und die Rahmenbedingungen, in denen sie ihre Funktionen für die Innovationen im ALV-Sektor erfüllen. Außerdem hebt die Studie die Determinanten für erfolgreiche Innovationen hervor. Somit zeigt sie sowohl positive als auch negative Faktoren auf, die mit dem politischen Kontext, mit der Infrastruktur, Kapazitäten von und Interaktionen zwischen beteiligten Akteuren zusammenhängen.

Zentrale Ergebnisse der Studie

Institutionelle Rahmen und Kontextfaktoren: Um die Faktoren, die auf die Innovationsprozesse einen fördernden oder hemmenden Einfluss haben besser zu verstehen, hat die Studie die agrarpolitischen Rahmenbedingungen, die Infrastruktur und den Zugang zu Ressourcen analysiert. Diese Analyse hat gezeigt, dass die kenianische Agrarpolitik keinen klaren Fokus auf gartenbauliche Produktion und insbesondere auf die Förderung kleinbäuerlicher Betriebe hat. Stattdessen adressieren die staatlichen Fördermaßnahmen vor allem die export-orientierte

Produktion. Ein wichtiger politischer Prozess ist die laufende Dezentralisierung, um das Umsetzungsmandat stärker an die lokalen Behörden der relativ neu strukturierten 47 Counties zu übergeben. Der Dezentralisierungsprozess übergibt den Lokalregierungen die Macht, eigene Entwicklungsprioritäten zu setzen und eröffnet damit neue Chancen für die Produktion indigener Blattgemüsearten. Die Entscheidungsmacht für neue Gesetze und Verordnungen verbleibt jedoch bei der Nationalregierung.

Die Studie zeigt auch, dass die Infrastruktur, insbesondere das Transport- und Kommunikationswesen, der wichtigste Hemmfaktor für einen inklusiven Marktzugang und die effektive Verbreitung neuer Innovationen ist. Hinzu kommt die ungleiche Verteilung landwirtschaftlicher Nutzflächen, die vor allem Frauen und junge BäuerInnen betrifft und die Möglichkeit einschränkt, auf eigenen Landflächen innovative Experimente durchzuführen. Ein weiterer Faktor ist der limitierte Zugang zu Finanzressourcen, der sowohl für KleinbäuerInnen als auch für ForscherInnen gilt.

Die ökonomischen Bedingungen und die Nachfrage nach indigenem Blattgemüse sind regional unterschiedlich. In Westkenia wird Blattgemüse seit Generationen von vielen kleinbäuerlichen Betrieben angebaut und ist ein wichtiger Bestandteil der traditionellen Ernährung. Trotzdem kann die Nachfrage auf lokalen Märkten nicht vollständig abgedeckt werden. In Zentralkenia hingegen wird Blattgemüse nur von wenigen Betrieben angebaut und die Nachfrage auf den dynamischen urbanen Märkten hängt von den Präferenzen bestimmter Konsumentengruppen (Mittelklasse, BinnenmigrantInnen etc.) ab. Dementsprechend variiert auch der Kommerzialisierungslevel, da diese Blattgemüsearten in Westkenia eher von landwirtschaftlichen Subsistenzbetrieben angebaut werden, in Zentralkenia meistens von kommerziellen Betrieben.

Die Wertschöpfungskette von ALVs – Möglichkeiten für Innovationen: In der Studie werden ALV-Wertschöpfungsketten in zweidimensionaler Hinsicht unterschieden: Erstens anhand des Grads der Kommerzialisierung der Wertschöpfungsketten und ihrer Akteure, und zweitens anhand der regionalen Unterschiede der Produktionsstandorte. Dementsprechend empfiehlt die Studie Probleme in der Innovationsökologie von ALVs getrennt nach dem Kommerzialisierungsgrad der Wertschöpfungskette und regionalen Unterschieden zu betrachten.

Akteure des Innovationsystems: Die Studie analysiert die sechs Akteursgruppen nach den Kriterien: (1) Level der Zielgruppenorientierung, (2) institutionelle Interessen und Prioritäten, (3) Kapazitäten, Macht sowie humane-, finanzielle- und soziale Ressourcen, (4) Herausforderungen und Bedürfnisse.

Die Untersuchungen haben gezeigt, dass der staatliche landwirtschaftliche Beratungsdienst und die NROs, die Schlüsselakteure für die Förderung neuer Lösungen im ALV-Innovationssystem sind. Sie spielen eine bedeutende Rolle für die Verbindung der Forschungs- und Implementierungsebene. Allerdings verfügen diese Akteure nur über beschränkte Ressourcen. Insbesondere die humanen und finanziellen Kapazitäten des staatlichen Beratungsdienstes müssen ausgebaut und verstärkt werden. Landwirtschaftliche Trainingszentren und Colleges sind in ganz Kenia gut repräsentiert und spielen eine ähnlich aktive Rolle in der Informationsverbreitung. Sie leisten u.a. einen wichtigen Beitrag für die Aus- und Weiterbildung künftiger landwirtschaftlicher BeraterInnen, leiden aber gegenwärtig ebenfalls unter knappen Ressourcen und Kapazitäten. Die Integration von Lernmodulen zu indigenem Blattgemüse in die Lehrpläne dieser Organisationen kann für die nachhaltige Umsetzung der Forschungsergebnisse sehr hilfreich sein.

Die County-Regierungen und die *Kenya Agriculture and Livestock Organisation* (KALRO- früher KARI- *Kenya Agriculture Research Institute*) sind weitere wichtige Akteure. Die west- und zentralkenianischen lokalen Regierungseinheiten sind an der Förderung und Unterstützung der ALV-Produktion sehr interessiert. Allerdings bereiten die verlangsamten Dezentralisierungsmaßnahmen diverse Herausforderungen, da auch hier Ressourcen nur beschränkt zugänglich sind oder gar fehlen. Dagegen kann die neustrukturierte KALRO als wichtigster nationaler Akteur eine koordinierende und verbindende Funktion im Innovationssystem übernehmen.

Weiterhin bedeutend für die ALV-Forschung und –Förderung bleiben die Universitäten, da sie sich nicht nur mit der Generierung, sondern auch mit Verbreitung neuer Innovationen beschäftigen. Die wohl entscheidendste Akteursgruppe für die Innovationsprozesse sind jedoch die BäuerInnen. Sie sind aktive InnovatorInnen und entscheiden über die erfolgreiche und nachhaltige Umsetzung und Adaptation von neuen Lösungen. In dieser Studie werden sie in landwirtschaftliche Subsistenzbetriebe (mit beschränkten Kapazitäten und zahlreichen Herausforderungen) und in kommerzielle Betriebe (mit besserem Zugang zu Information, Infrastruktur und landwirtschaftlicher Beratung) unterteilt, für die unterschiedliche und entsprechend angepasste Innovationen und Förderung notwendig sind.

Interaktionen: Die Studie hat (1) die Kanäle des Informationstransfers, (2) die Relevanz und die Qualität dieser Informationen, (3) den Ressourcentransfer, (4) die Koordinierungs- und Kooperationsmethoden sowie (5) die Machtbeziehungen zwischen den Akteuren im Innovationssystem analysiert. Im Ergebnis wurde deutlich, dass die direkte (*face-to-face*) Kommunikation für die BäuerInnen der beste Weg für den Wissensaustausch ist. Im Vergleich zu anderen Kanälen erlaubt es

direkte Kommunikation, insbesondere in entlegenen Regionen zielgruppenorientierte Informationen zu verbreiten. Außerdem wird direktes Feedback über die Weiterentwicklung der Innovationen ermöglicht. Besonders für ärmere Bevölkerungsgruppen spielt die Informationsverbreitung über das Radio eine wichtige Rolle, da das vermittelte Wissen besser zugänglich, bezahlbar und verständlich ist. Bezüglich der Relevanz und Qualität von Information besteht ein Bedarf an effektiven Wissensmanagementsystemen und Mechanismen der Qualitätskontrolle, da es oftmals zu Überschneidungen und Duplikationen in der Forschung kommt. Der Zugang zu sowie der Transfer von Ressourcen sollte ebenfalls verbessert und angepasst werden.

Gleichzeitig hat die Studie Innovationsmöglichkeiten in bestehenden Kooperationen festgestellt. Der direkte (*face-to-face*) Wissensaustausch, landwirtschaftliche Selbsthilfestrukturen sowie die zahlreichen Entwicklungsprojekte mit koordinierten und integrierten Ansätzen gelten als wichtige *Entry-Points* für neue Interventionen. Viele diese Interaktionsmechanismen und die effektive Arbeit der Beratungsdienste (auch nicht-staatlicher) sind von Ressourcen abhängig, die oft fehlen. Dadurch haben die ressourcenstarken Geber und Privatsektorakteure großen Einfluss auf das Design der Interventionen. Dies führt nicht selten zur Implementierung von Maßnahmen, die die realen Bedürfnisse der BäuerInnen in Kenia nicht berücksichtigen.

Empfehlungen: Basierend auf der Bewertung der Innovationsökologie für ALVs zeigt die Studie Möglichkeiten für Innovationen auf und gibt Empfehlungen, um Aspekte der Innovationsökologie zu verbessern.

- Um die Teilnahme verschiedener Akteure – darunter SubsistenzbäuerInnen, Frauen und Jugendliche – im Innovationsprozess von ALVs zu verbessern und eine inklusive Innovationsökologie zu schaffen, empfiehlt die Studie strukturell-sozio-ökonomische Probleme von ALVs auf allen Ebenen zu adressieren, von nationalen Entwicklungszielen bis zu lokalen Politiken und Programmen. Zeitgleich identifiziert die Studie die Notwendigkeit, von wohlgemeinter Politikgestaltung zu tatsächlichen pro-poor-Programmen zu wechseln, unter Berücksichtigung der Potenziale der ALV-Produktion, um Herausforderungen der Ernährungssicherheit zu adressieren.
- Probleme in der Innovationsökologie von ALVs sollten getrennt nach Wertschöpfungskette und regionalen Unterschieden adressiert werden. Darüber hinaus muss nachfrageorientierte Forschung Bedürfnisse von BäuerInnen berücksichtigen und dabei das indigene Wissen, lokale Lösungen und Feedback von BäuerInnen in den kompletten Forschungsprozess einbeziehen. BäuerIn-

nen sind aktive InnovatorInnen und somit Schlüssel zum Erfolg eines jeden Schritts des Innovationskreises, von der Forschung bis hin zur Umsetzung der Forschungsergebnisse. Um eine inklusive und erfolgreiche pro-poor-Innovationsökologie zu schaffen, müssen sie gestärkt und gefördert werden.

- Die Kooperation zwischen Akteuren der Innovationsökologie, darunter HORTINLEA, und Akteuren der Zivilgesellschaft sollte intensiviert werden. Die pro-poor-Zielgruppenorientierung zivilgesellschaftlicher Akteure, die direkt auf lokaler Ebene arbeiten, sollte als großes Potential zum Netzwerken und Zusammenarbeiten gesehen werden. Zeitgleich sollte KALROs Potential gründlich erforscht werden. Durch ihre Funktion, personellen und finanziellen Ressourcen und breite geografische Verteilung, ist KALRO eine der geeignetsten kenianischen Institutionen zur Förderung der Umsetzung von Forschungsergebnissen und Innovationen auf nationaler und regionaler Ebene. Um kenianische Strukturen nachhaltig zu unterstützen und die gesamte landwirtschaftliche Innovationsökologie zu stärken ohne parallel laufende Innovationsplattformen zu schaffen, sollte das geplante KALRO College als ein wichtiger Eintrittspunkt für Akteure wie HORTINLEA berücksichtigt werden.
- Die Studie empfiehlt darüber hinaus, ALVs in die Lehrpläne des Bildungssystems zu integrieren. Obwohl Bildungsinstitutionen alle Teile Kenias abdecken, erreichen sie durch fehlende personelle und finanzielle Ressourcen nur eine begrenzte Anzahl an BäuerInnen.
- Entwicklungsorganisationen / Geber, die nationale kenianische Regierung und die internationalen Forschungsinstitutionen in Kenia sind sehr einflussreich, scheinen bisher aber recht wenig an ALVs interessiert zu sein. Sie müssen verstärkt sensibilisiert und integriert werden, um ihre Kapazitäten nutzen zu können.
- Während der Privatsektor durch seine eigennützigen Interessen und großen Einfluss auf die Politikgestaltung von vielen kritisch betrachtet wird, müssen einige Akteure als potentielle Partner für verschiedene Aufgaben im Innovationsprozess, von Bereitstellung von Inputs bis hin zu Verbreitung von wertvollen Informationen, in Betracht gezogen werden.
- Die vermittelnden Akteure (staatliche Beratungsdienste, lokale NGOs und Medien) müssen am meisten in ihren finanziellen Ressourcen und personellen Kapazitäten gestärkt werden, um die Informationslücke zwischen Forschung und BäuerInnen zu schließen. Nur durch die Einbeziehung von vermittelnden Akteuren wird die Umsetzung von weitgehend zielgruppenorientierten *pro-*

poor-Strategien ermöglicht, die direkt bei entlegenen und armen BäuerInnen ansetzen und ihre Teilnahme am Innovationsprozess sicherstellen.

- Für eine gezielte Verbreitungsstrategie der Forschungsergebnisse ist es wichtig, die richtigen Kommunikationskanäle und Sprache zu wählen, um Bezahlbarkeit, Zugang und Nutzbarkeit bei der Zielgruppe sicherzustellen. Darüber hinaus müssen Akteure, die Wissen verbreiten (öffentliche, NGOs oder private) in einer transparenten Art und Weise reguliert werden, um sicherzustellen, dass sie nationalen und lokalen Entwicklungen sowie strategischen Prioritäten folgen. Nur Lösungen, die für (arme) BäuerInnen relevant und umsetzbar sind, werden erfolgreiche pro-poor-Innovationen. Um zu gewährleisten, dass die richtigen Erkenntnisse auch die richtigen Menschen erreichen, muss der Wandel in Forschungs- und Informationsweitergabe durch gut koordinierte und frei zugängliche Managementsysteme begleitet werden. Die weitergegebenen Erkenntnisse und Informationen müssen kontinuierlich einer strengen Qualitätskontrolle unterzogen werden.
- Zu guter Letzt empfiehlt die Studie Akteuren wie HORTINLEA, die in die Innovationsökologie von ALVs involviert sind, dass sie *die Innovation Systems Perspective* nutzen, um Innovationsprozesse, die sie unterstützen und mitbestimmen, zu optimieren.

Die Studie zeigt darüber hinaus den Bedarf für weiterführende Forschungen in der Innovationsökologie oder zu konkreten Fragen hinsichtlich von ALVs auf. Es wird empfohlen, den Fokus weiterführender Studien auf die Analyse der *pro-poor*-Potentiale von ALVs zu legen. Ebenso sollten weiterhin Faktoren untersucht werden, die sich mit der Bereitschaft und Fähigkeit der BäuerInnen beschäftigen Innovationen einzuführen oder sich neuen Lösungen anzupassen.

Anwendung der *Innovation System Perspective*

Ein problembasiertes Innovationssystem ermöglicht es den ForscherInnen, die relevanten Kontextfaktoren, Akteure und Interaktionen zu identifizieren, die die Umsetzung und den Erfolg von neuen Lösungen bestimmen. Während des transdisziplinären Forschungsprozesses hilft dieses Instrument den Schwerpunkt auf die praktische Umsetzung von Ergebnissen zu legen. Außerdem kann die Identifizierung von relevanten Akteuren die Forschenden dabei unterstützen, als Vermittler („Katalysatoren“) für deren Austausch zu agieren. Bereits das Zusammenbringen von Innovationsakteuren zum Austausch über Probleme und Sichtweisen kann zur Stärkung von Innovationen führen.

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Abbreviations

AIS	Agricultural Innovation System
AKIS	Agricultural Knowledge and Information System
ATCs	Agricultural Training Centres
ALVs	African Leafy Vegetables
ASDS	Agricultural Sector Development Strategy
AVRDC	The World Vegetable Center (previously: the Asian Vegetable Research and Development Center)
BMBF	German Federal Ministry of Education and Research
BMZ	German Federal Ministry for Economic Cooperation and Development
CGIAR	Consultative Group on International Agricultural Research
FAO	Food and Agriculture Organisation of the United Nations
FARA	Forum for Agricultural Research in Africa
FCI	Farm Concern International
FGD	Focus Group Discussion
FGI	Farmer Group Interviews
GIZ	German Development Cooperation (<i>Deutsche Gesellschaft für Internationale Zusammenarbeit</i>)
Globe	Global Food Security (initiative of the BMBF - <i>Globale Ernährungssicherung</i> - Globe)
GOK	Government of Kenya
HCDA	Horticultural Crops Development Authority
HORTINLEA	Horticultural Innovations and Learning for Improved Nutrition and Livelihood in East Africa
IAR4D	Integrated Agricultural Research for Development
IARC	International Agricultural Research Centre
ICIPE	International Centre of Insect Physiology and Ecology
ICT	Information and Communications Technology
ILRI	International Livestock Research Institute
ISP	Innovation Systems Perspective
JKUAT	Jomo Kenyatta University of Agriculture and Technology
KAINET	Kenya Agricultural Information Network
KALRO	Kenya Agricultural Livestock and Research Organisation (previously: Kenya Agricultural Research Institute - KARI)
KAPAP	Kenya Agricultural Productivity and Agribusiness Project (previously: Kenya Agricultural Productivity Project -KAPP)

XXIV Abbreviations

KBC	Kenya Broadcasting Corporation
KEFAAS	Kenya Forum for Agricultural Advisory Services
KEFRI	Kenya Forestry Research Institute
KEPHIS	Kenya Plant Health Inspectorate Service
KIPPRA	Kenya Institute for Public Policy Research and Analysis
KOAN	Kenya Organic Agricultural Network
MOA	Ministry of Agriculture
MOE	Ministry of Education
MOH	Ministry of Health
MOU	Memorandum of Understanding
NAETS	National Agricultural Education and Training System
NARS	National Agricultural Research System
NASEP	National Agricultural Sector Extension Policy
NSF	National Systems Framework
Q&A	Question and Answer
R&D	Research and Development
ROP	Rural Outreach Programme
SACDEP	Sustainable Agriculture Community Development Programmes
SLE	Centre for Rural Development (<i>Seminar für Ländliche Entwicklung</i> - SLE)
StM	Stakeholder Meeting(s)
USAid	United States Agency for International Development

Part I: Background, Conceptual Framework and Methodology

1 Introduction

1.1 Core problem and purpose of the study

Kenya is currently facing many challenges to food security in general, and specifically to nutritional security. These challenges affect both the rural and (peri-) urban population, and are attributable to different factors, including a high poverty rate. In addition, the immense knowledge gained through agricultural research conducted worldwide and in Kenya, which aims at addressing food security challenges, very frequently fails to be disseminated to and utilised by farmers effectively. This information-implementation gap between research and practice prevents innovations from reaching the poor, thereby precluding a possible positive impact towards alleviating malnutrition.

More than 18 German and Kenyan universities and agricultural research centres are currently carrying out the multi-stakeholder interdisciplinary research project Horticultural Innovation and Learning for Improved Livelihood and Nutrition in East Africa (HORTINLEA), with a particular focus on Kenya (2013-2018), and with the ultimate aim of alleviating malnutrition and poverty through agricultural innovation. HORTINLEA is embedded in a new funding initiative for global food security (*Globale Ernährungssicherung* - GlobE) of the German Federal Ministry of Education and Research (BMBF) and the Federal Ministry for Economic Cooperation and Development (BMZ). It specifically aims at improving the livelihoods and nutrition of the rural and urban poor in East Africa by developing and implementing innovations along the value chain of African Leafy Vegetables (ALVs). The utilisation of research results by farmers is often problematic since the innovations researched and suggested may not address farmers' needs and demands. In order to increase the uptake and utilisation of scientific research results by poor target groups, solutions must be applicable, context- and problem-oriented, gender sensitive and financially affordable and profitable, i.e. they should fit into the economic, cultural and social context of the envisaged target group. A system-oriented understanding of how the scientific solutions developed by HORTINLEA can become successful innovations within the Kenyan context is a crucial precondition for achieving the goal of successful transfer und implementation of research findings.

2 Introduction

Therefore HORTINLEA commissioned the Centre for Rural Development (SLE) to conduct this study, which assesses processes and systems of innovation in Kenya regarding ALVs. The study provides an insight into the overall system in which innovation occurs, i.e. the actors and their capacity to innovate, their interactions regarding the transfer and exchange of knowledge, their power relations, as well as the underlying institutional, social and cultural background. The findings of this comprehensive analysis will form the basis for stakeholder engagement and knowledge exchange processes in order to make pro-poor solutions work. Accordingly, the study aims to raise awareness among the HORTINLEA researchers and other relevant actors about pro-poor innovation processes. It also provides information about the opportunities that could enable further development, implementation, adaptation and use of innovations. In so doing, the study contributes to one of the specific objectives of the HORTINLEA project, namely the transfer and dissemination of its research results. Thus, the purpose of the SLE-study is to identify the key actors in the innovation system of indigenous vegetables, to analyse the links and information flows between different actors, to explore how these inhibit or support pro-poor innovations and to analyse determinants of the utilisation of scientific research results.

1.2 Objectives of the study

The study aims at contributing to closing the information-implementation gap between existing knowledge, research, policy and practice by analysing the systemic conditions under which agricultural pro-poor innovations in the Kenyan ALV sub-sector are developed, disseminated and implemented.

The specific objectives that contribute to the aim of the study are as follows:

- I. Assessment of the status quo and the dynamics of different innovation systems for ALVs in Kenya, comprising:
 - Analysis of the institutional and context factors influencing ALV innovation processes
 - Identification of key actors in innovation systems and overview of the involvement of women and youth
 - Overview of the links and the relationships between these actors as well as the flow of information within the innovation systems for ALVs
 - Assessment of selected implemented (or failed) innovations, and lessons learned

- II. Assessment of possible entry points for researchers in areas relevant to the transfer and utilisation of HORTINLEA results. Application of a problem-based innovation system focussing on a specific problem in the production, marketing or consumption of ALVs.

1.3 Outline of the Report

The structure of the report mirrors the research process of analysing the innovation system of ALVs in Kenya. The study consists of theoretical and empirical parts and an exemplary application that helps to keep practical implementation in focus throughout the transdisciplinary research process. The report is divided into ten chapters. Following this introduction, the second chapter of the theoretical part describes and analyses the context, first Kenya in general and then the study region in more detail. It also highlights the potential of ALVs to tackle problems of poverty and malnutrition. The general framework of the study as well as approaches and concepts are delineated in Chapter 3 of Part I. In this chapter the evaluation of different frameworks for agricultural research and development (R&D) and the development of the Innovation Systems Perspective (which builds on successful elements of previous approaches) are presented and explained. The last chapter of Part I explains the study's methodology, including its operationalisation into research areas as well as the empirical methods employed in order to assess the innovation system for ALVs. The empirical scope of the study is also outlined in this chapter.

Part II lays out the empirical findings from the following 4 main research areas (Chapters 1 – 4 in Part II): (1) the determinants for innovation processes related to the political and socio-economic context; (2) the value chain of ALVs with focus on innovation opportunities; (3) the six main groups of actors with relevant functions and roles; (4) the links and relationships between these actors as well as the quality and direction of interactions within the ALV innovation system. The final conclusion gives a cohesive analysis of the ALV innovation system in Kenya. It also identifies needs for further research and makes recommendations for improving pro-poor innovation processes.

In addition, Part III demonstrates step by step how to apply the Innovation Systems Perspective to a specific value chain problem using the example of ALV seed supply in Kenya.

2 Background

2.1 Overview of the Kenyan background

Kenya became an independent country in 1963 when the former British colonial administration handed over power in a negotiated process that followed prolonged political unrest (Anderson, 2005, p.23). The unequal distribution of agricultural land, which had been a major issue during colonial times, remained largely unresolved as the new political elite used their power in the following decades to take over private land ownership from the white settlers. A large number of small-holder farmers working on very little land remained impoverished.

The colonial economy had made use of Kenya's agricultural potential – 18% of land has a medium or high agricultural value (cf. Adimo, 2014). This proportion consists mostly of the central and western parts of the country and has historically been used for growing crops such as coffee and tea. This orientation towards high-value export crops largely persisted after independence. However, subsistence agriculture was and still is practised by large numbers of farmers on very small plots that remain outside the large-scale farms.

Today, Kenya is the largest economy in the East African region, with a gross domestic product (GDP) of over US\$44 billion (KIPPRA, 2013). In theory, Kenya's system of governance is a presidential democracy. In practice, there are major challenges, two of the most pressing ones being ethnically charged politics (which erupted into the 2007/08 post-election violence) and high levels of corruption. Among the World Bank's Worldwide Governance Indicators, both *Political Stability* and *Control of Corruption* have been on a downward trend over the last ten years (WGI, 2014). A very elite-driven system of allocating public resources including agricultural land (often according to tribal divisions) contributes to rising social inequality.¹

Kenya's active civil society, which advocates on a range of issues including poverty reduction and nutrition-oriented agricultural policy, experienced a recent setback when the government de-registered more than 500 NGOs in December 2014 (Freedom House, 2014).

In terms of infrastructural development, much remains to be done in Kenya. Although there is an extensive network of roads, the percentage of paved roads in

1 The GINI-coefficient went up from 42.5 in 1997 to 47.7 in 2005 (cf. *IndexMundi*, 2014).

the overall network was 14.3% in Kenya in 2009. This was well below the average for sub-Saharan Africa at 18.3% (FAO, 2013, p. 23). In terms of water supply, almost 50% of the population rely on surface water, again a higher proportion than in most other low-income African countries, where it is only a third (Briceño-Garmendia and Shkaratan, 2011, p. 12). Concerning access to information and communication technologies (ICT), Kenya has recently made notable progress in mobile telephone coverage, which reaches 86.2% of the population today. However, the costs of using these networks are “significantly higher in Kenya than in comparable African countries” (Briceño-Garmendia and Shkaratan, 2011, pp. 22f.).

Poverty and malnutrition

Kenya’s population was 44.35 million in 2013, of which 45.9% lived below the poverty line of \$1 a day (GOK, 2011, p. 4).² Out of all poor, 68% lived in rural areas, which means that poverty in Kenya is mainly a rural phenomenon (FAO, 2013, 23). The livelihood of an overwhelming majority (75%) of farmers depends on agriculture and half of agricultural output remains subsistence production (GOK, 2007, 9). Poverty-related challenges include widespread hunger in general and specifically hidden hunger. The first Millennium Development Goal of eradicating hunger is commonly measured by the percentage of underweight children less than five years of age. In Kenya, that proportion stood at 16.2% in 2011 (GOK, 2011a, p. 4).

Less visible than outright starvation, though similarly harmful, is hidden hunger, a form of malnutrition defined as a chronic lack of vitamins and other essential micronutrients. Recent research places Kenya second-highest among 149 countries worldwide on the Hidden Hunger Index (overall score of 51.7) (Muthayya et al., 2013). Hidden hunger can lead to stunted growth in children and lifelong negative consequences for health and productivity. Child mortality is another indicator of the gravity of the problem. It was found to be associated with malnutrition in 54% of child deaths in developing countries in 2001. In Kenya in 2013, child mortality stood at 71 in every 1000 live births for children under the age of 5 (World Bank, 2014).

Paradoxically, hidden hunger has been worsened by measures to combat hunger. Programmes in the so-called Green Revolution aggressively supported high-yielding staple crops and neglected other crops rich in micro-nutrients (such as vegetables and legumes) (Welthungerhilfe, 2014, p. 27).

² Poverty is defined here in economic terms (by the indicator of household income), because the range of stakeholders along the value chain is presumed to be too diverse to be subsumed into a complex multi-dimensional model of poverty.

2.2 Potentials of African Leafy Vegetables

In order to determine the current (and future) positioning of African Leafy Vegetables (ALVs) within Kenyan agriculture it is important to first understand the structure and priorities of the agricultural sector in general, and specifically the horticultural subsector, of which ALVs form an important part.

2.2.1 Agriculture and agricultural research in Kenya

Agriculture contributes 25% of Kenya's overall GDP and the sector employs 75% of the national labour force. The most important products according to their contribution to agricultural GDP are vegetables (20%), maize (15%), legumes (14%), livestock (12%), tea (11%) and cut flowers (7%) (FAO, 2013, p. 34).

The most important agricultural policies are the Agricultural Sector Development Strategy (ASDS) and the National Horticulture Policy (NHP). Generally, these policies aim at commercialising Kenyan agriculture, emphasising the integration of private stakeholders in research, food production and marketing.

An overall growth in the agricultural sector of 5.6% in 2010 has been attributed to "enhanced dissemination of agricultural technologies, provision of subsidised inputs to farmers and increase in the area under irrigation" (FAO, 2013, p. 21). This points to the importance of agricultural research and supporting farmers with physical inputs on a broad scale. However, the figure says nothing about the distribution of growth between subsectors and its impact on the different strata of the farming population.

The available funding for agricultural research in Kenya has shown no clear trend over the last twenty years but has fluctuated roughly around \$150 million, with increases and decreases of up to \$20 Million. Fluctuations are attributed to trends in international donor funding, which contributes about one third of the total, with the national government providing the largest share. This figure makes Kenyan agricultural research relatively well-funded in comparison to many other sub-Saharan Africa countries (Flaherty et al., 2010, pp. 1; 7).

However, while the Kenyan government pledged in the 2003 Maputo Declaration to spend at least 10% of its national budget on agriculture and to achieve at least 6% annual growth in the agricultural sector, this spending target has failed as agricultural spending is currently below 5% (Praskova, 2013; Koross, 2013; Benin and Yu, 2012, p. 21f.). In addition, the Maputo target says nothing about the allocation of spending on agriculture by sector, income bracket of farmers, etc.

2.2.2 Horticulture and smallholder production

Horticulture is the most important agricultural subsector, earning over US\$300 million annually through exports (HCDA, 2013, p. 4). While 75% of total agricultural output is grown on farms of less than 5ha in size, the majority of export crops (such as tea) are typically grown on large farms (FAO, 2013, pp. 23; 34). The proportion of exported vegetables that are grown by smallholder farmers dropped over the last ten years from 60% to 30% (Praskova, 2013). In addition, small-scale farmers engaged in horticultural export production, notably women farmers, face great economic risks (Velte and Dannenberg, 2014).

Instead, small-scale farming focuses mostly on subsistence. It is especially women who provide most of the labour in this sector. At the same time women rarely hold titles to their land, which is generally owned by men (ibid.).

2.2.3 African Leafy Vegetables

An important product for small-scale and especially subsistence-focused horticulture in Kenya has historically been the so-called African Leafy Vegetables (ALVs). The ALVs comprise a range of leafy vegetable species whose primary or secondary origin³ is on the African continent. Alternative designations are African indigenous (primary origin) or traditional (secondary origin) vegetables (Abukutsa, 2006).⁴ This designation serves to distinguish ALVs from vegetables more recently introduced to Africa such as spinach or kales (so-called exotic vegetables).

In Kenya, some of the most common ALV species are Amaranth (bot.: *Amaranthus spp*, Kiswahili: *mchicha*), African Nightshade (bot.: *Solanum villosum*, Kiswahili: *mnavu*) and Spider Plant (bot.: *Cleome gynandra*, Kiswahili *mwangani*). In some areas of Kenya, most notably in the west, these vegetables have been grown and consumed for generations.

The potential of ALVs to help solve the problem of malnutrition in Kenya has been argued with reference to their high content in micronutrients. In comparison to spinach, for instance, the three above-mentioned varieties contain around twice the amount of protein, 2-4 times the amount of calcium, 1.5-2 times as much vitamin A and more than 4 times as much vitamin C (Abukutsa, 2006, p20).

3 Imported plant species have their secondary origin in a region where they “due to long use have become part of the culture of a people” (Abukutsa, 2006, p18).

4 This study uses the term African Leafy Vegetables as it encompasses varieties of primary and of secondary African origin.

Therefore, ALVs can serve to prevent the negative effects of hidden hunger if they are part of the regular diet.



In addition, it has been claimed that enhanced production and marketing of ALVs could contribute to reducing poverty through income generation. There are some indications of the high market potential of ALVs. For instance, a 2012 study into the willingness to pay a premium for ALVs in Eldoroet Town in Kenya showed that urban consumers “generally preferred ALVs” and were also ready to pay 79% more than they would have paid for exotic vegetables (Chelang’a et al., 2012). They also require few inputs because they are well adapted to the ecological conditions in Kenya and are mostly produced by smallholder farmers (Abukutsa, 2006, p. 19ff.).

3 Conceptual framework

As argued above, ALVs have a large potential for alleviating poverty, hunger and malnutrition among (poor) farmers. However, this potential must be supported by research efforts, such as HORTINLEA, that address farmers' needs and difficulties and take into account their existing knowledge. Research can then produce better, more relevant and adoptable results. Also, innovative solutions often do not reach farmers or farmers are unable to apply them for a number of reasons. The resulting information-implementation gap can, however, be closed, if all actors involved in agricultural research and development (R&D) apply a systemic perspective to the entire process of innovation as outlined in the following conceptual framework of this study.

3.1 The evolution of agricultural Research and Development frameworks

Processes of research and the implementation of new solutions are conceptualised in the study as *innovations*. This includes efforts to research and disseminate already existing knowledge, good practices and technology in order to up-scale their distribution, utilisation and impact among the farming population and other value-chain actors (for an exact definition of the term innovation, see Part I, 3.2.1). Experience has shown that for innovations to be implemented and to benefit farmers, including very poor farmers, many prerequisites have to be met. When attempting to connect research and practice, it is therefore crucial to choose an approach which enables all actors involved in R&D to understand both the general framework as well as the entire process of agricultural innovation. The study subsequently employs the Innovation Systems Perspective (ISP) as a conceptual framework in order to meet these criteria and to be able to assess the overall systemic conditions and determinants for innovation in the ALV sector. The elements of this approach build on experiences with previous theoretical and practical / institutional approaches to R&D in agriculture and beyond. Its evolution is outlined briefly below.

Since independence, countries in sub-Saharan Africa have had to manage complex institutional and organisational transitions in their public sector systems. At the same time, research approaches have evolved from participatory research methods to *integrated agricultural research for development* (IAR4D). To explain the setup of the current R&D institutions in Kenya, and also to understand the

12 Conceptual framework

evolution of the ISP, it is important to keep in mind previous approaches. A brief illustration of the logic of the concepts relevant to this study is given below.

The evolution of agricultural research paradigms

More participatory research methods started to evolve in response to the understanding that non-adoption of technologies resulted from the top-down teaching approaches that characterised most sub-Saharan research and extension after independence. Whereas in former top-down approaches the researchers determined “what is good for the farmer” (Anandajayasekeram et al., 2008, p. 39), a participatory approach allows for periods of consultation with the farmer, of experimentation with and adoption of the technology.

The recently developed research approach, *integrated agricultural research for development* (IAR4D), takes the empowerment and participation of farmers in the R&D process a step further and attempts to overcome the still predominant top-down approach that characterises most research and development interventions. It takes a systemic view of agricultural development, focusing not only on intensifying smallholder agriculture and improving natural resource management, but also the inclusive development of effective markets and policies. It promotes a cross-disciplinary research approach, capacity-building of all relevant stakeholders, organisational and institutional change, multi-stakeholder collaboration including farmers, effective information and knowledge management as well as continuous monitoring and evaluation of the research results’ impact on farming systems.

The evolution of the institutional research structure in sub-Saharan Africa

For many sub-Saharan countries, in the early years following independence, the national agricultural research institutes (NARIs) were the only relevant players in the field of agricultural research, and their mission focused mainly on increasing food production and the export of cash-crops through technology transfer (Anandajayasekeram et al., 2008, p. 45). The evolution of the National Systems Framework (NSF) responded to the acceptance of the pluralistic nature of actors involved in agricultural research. The NSF became the umbrella for three systems, the National Agricultural Research System (NARS), the National Agricultural Extension System (NAES) and the National Agricultural Education and Training System (NAETS), which however continued to act mostly separately.

The growing appreciation of the need for stronger links between the respective parts of the NSF led to the idea of the Agricultural Knowledge and Information System (AKIS), which for the first time aimed to apply a truly systemic

perspective to R&D. Research, extension and education are seen as the three corners of a “knowledge triangle” (Anandajayasekaram et al., 2008, p. 46), in which the institutions are no longer separate, but rather work on different levels as part of a single AKIS. Knowledge generation and dissemination are the central activities of the AKIS, whose aim is to link people and institutions to promote mutual learning and generate, share, and utilise agriculture-related technology, knowledge and information (FAO and World Bank, 2000).

In addition to the knowledge triangle, the AKIS also takes into account context factors such as the policy environment, the structural environment, governance structures and external actors, such as donors or the private sector (Anandajayasekaram et al., 2008, 36f.).

Contemporary challenges in R&D - from AKIS and AIR₄D to the Innovation Systems Perspective

While newer approaches have indeed taken into account many of the previous challenges by applying a more systemic perspective to agricultural R&D, from the theoretical, research and institutional points of view, they still show some shortcomings in relation to the real-life problems faced by agricultural R&D institutions and practice, as well as to a more holistic conceptualisation of the entire process of innovation, i.e. the utilisation of research results and innovative solutions.

- The AKIS model of agricultural innovation is still too linear, and focuses too much on knowledge generation, thereby neglecting the process and determinants of dissemination, adaptation and adoption of innovative solutions.
- As a consequence, the demand side of agricultural research has continuously failed to be addressed adequately, resulting in research results often failing to reach, or be relevant to, the farmers or other actors. Currently, however, the goal of the system is becoming broader, and the impact rather than the output of research is now the measure of success. Since it is now expected to contribute to broader development priorities, R&D is often dubbed research for development (R₄D), as reflected by IAR₄D.
- The agricultural R&D arena has generally become more complex, meaning a greater number of actors are involved as essential components of the system, rather than as external (environmental) factors or only as partners to the traditional R&D actors. Innovation does not necessarily originate within the knowledge triangle. Many actors can be the source of innovation, including farmers and the private sector. Many more actors are involved as essential elements in the entire innovation process.

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- It is therefore important to conceptualise the issue of interactions, collaborations and networks between the multiple actors involved in innovation processes as crucial to the overall success of the system.

In conclusion, the evolution of agricultural research frameworks over the last fifty years in sub-Saharan Africa has begun to change course on the issue of how to put research into practice. Whereas earlier frameworks focused on research institutions as the primary source of knowledge generation, evolving frameworks additionally stressed the role of the extension and education system. However, contemporary studies show that the demand and needs, as well as the innovative potentials of farmers are still not considered sufficiently, and that the role of other actors and interactions between actors is neglected. The Innovation Systems Perspective aims to close this gap by considering the utilisation of results in R&D programmes from the outset.

3.2 The Innovation Systems Perspective

The Innovation Systems Perspective (ISP) builds on successful elements of previous approaches and responds to the contemporary challenges mentioned above by emphasising the process by which new agricultural knowledge is put to use. It is an analytical framework, not a coherent theory of blue-print for successful innovation. It lets actors analyse the determinants of a specific innovation, including their own and other actors' roles, interactions and relationships as well as the socio-economic context and the political and cultural conditions that affect the rules of the game in order to better plan their activities, policies or interventions together with other actors involved in the innovation process.

3.2.1 Invention versus innovation

The concept draws a distinction between the terms "invention" and "innovation", putting the emphasis on the process of innovation. An invention is only the generation of a new technology, practice or organisational structure. In contrast, innovation describes the process of "putting into practice a new way of doing things" (Gildemacher and Wongtschowski, 2013), including the generation, dissemination, adaptation and adoption of knowledge or the deployment of existing knowledge in a new context. An invention will only become an innovation if it is implemented on the user level and has a clear economic or social impact (Edquist, 1997). An improved seed variety, for example, will be rejected if the plant that grows from it does not fit into the meal culture of the producers or consumers.

This broad definition hints at innovations being not only technical solutions developed in a research institute but also social, organisational, process or business solutions (Malerba, 2002; Lundvall, et al., 2009; World Bank, 2011). Whereas an invention occurs only once (which is why the inventor gets due credit for it), innovations may occur multiple times, e.g. a new farming practice already used in northern Kenya may become an innovation in southern Kenya as well when it is successfully adopted there.

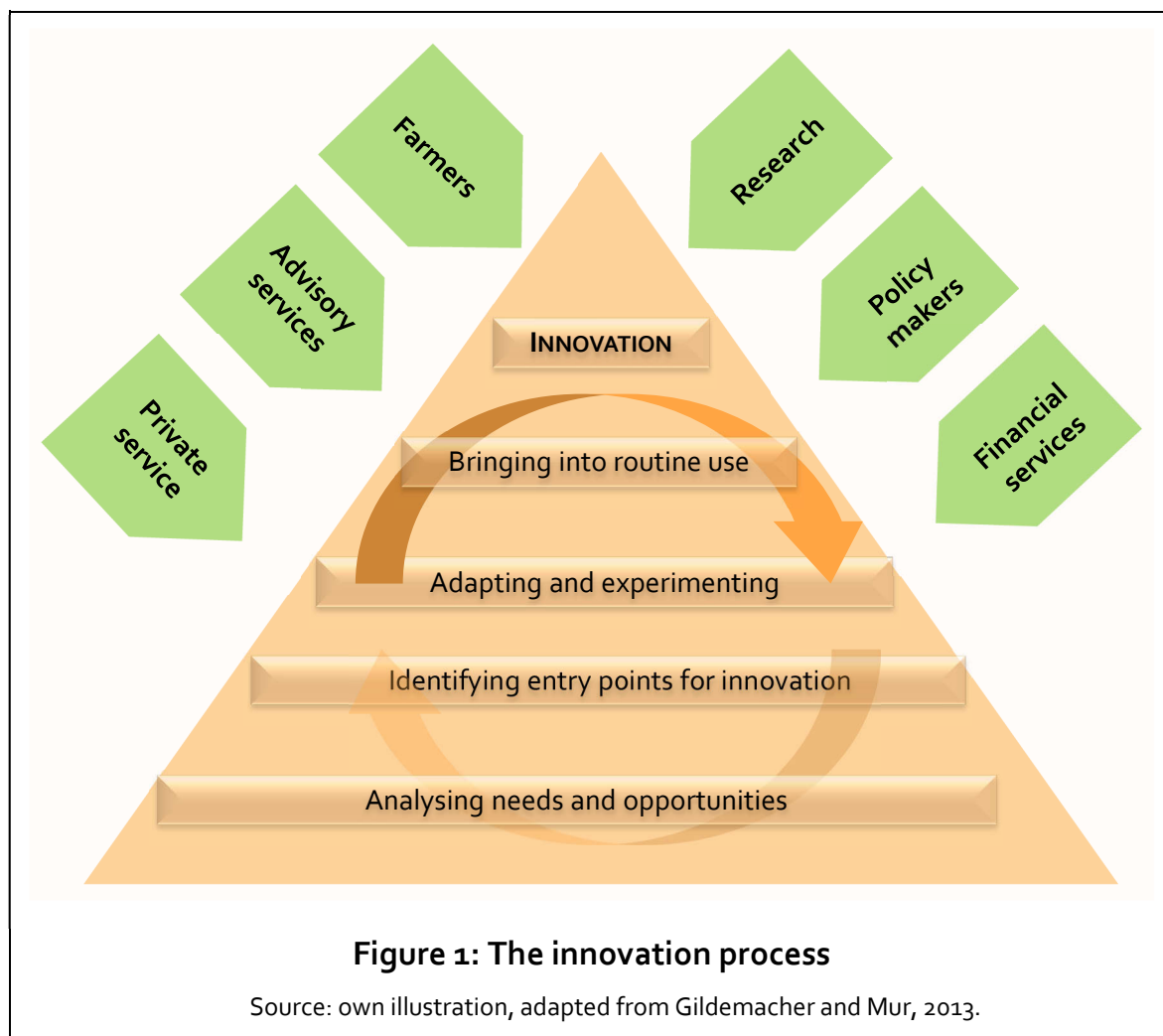
3.2.2 The systems perspective

The Innovation Systems Perspective incorporates the systems perspective from previous R&D approaches such as the AKIS and builds on it. Innovations can take place at micro, meso and macro level and may be initiated by different actors (public or private), because of different opportunities or triggers (policies, markets) and for different purposes (e.g. economic growth, poverty alleviation, agricultural development). They are the “products of networks of social and economic agents who interact with each other and, as a consequence of this interaction, create new ways to deal with social or economic processes” (Berdegúé, 2005, p.4).

In summary, an innovation system includes not only the “invention system” (i.e. mostly research) but also the economic, political and social processes and interactions between all relevant actors that turn an invention into an innovation. Research, previously considered the central actor of the system, is only one actor when it comes to the generation and adoption of new knowledge and practices (Fitzgerald et al., 2002). This does not mean that the ISP argues against the value of research, it merely adds another dimension, giving greater importance to the effectiveness with which research results and other innovative solutions are disseminated to other actors (Anandajayasekeram et al., 2008, p. 83). Innovations are therefore implemented in a system of interactive processes between a multitude of actors with specific functions, knowledge, resources and interests. To complete the systems perspective, institutions, laws, policies and cultural values affect actors’ behaviour and have to be taken into account as context factors.

3.2.3 Elements of the innovation process

In order to understand which actors need to be involved, when they should be involved, which linkages between them have to be strengthened and which institutional and context factors have to be supported to enable successful agricultural innovations (Gildemacher and Wongtschowski, 2013), the study discerns different elements and stages of innovation processes (Figure 1), as visualised in the pictogram below, adapted from Gildemacher and Mur (2012).



It is important to note that the ISP strongly rejects the old paradigm of the linear transfer of novel practices from research to extension to farmer. The diagram outlines important stages of the innovation process as conceived by the ISP (described in detail below). It shows the innovation process as non-linear, multi-directional or even circular in nature (Van de Fliert and Braun, 2002).

The starting point is the identification of needs and opportunities (analysis), followed by a period of experimentation (e.g. by researchers) and adaptation (e.g. by farmers involved in the research process) and, finally, the new practices being put into routine use (adoption). An analysis of needs and opportunities may be conducted by all actors involved in an innovation system, whether farmers, researchers, policy makers, private entrepreneurs or others. These actors then set out to find a relevant solution to an identified problem. One of the reasons why solutions generated by academic research institutions often fail to be adopted is because of insufficient assessment of needs and opportunities. The subsequent adaptation of a new idea, technology, process or organisational structure involves

experimenting with it at the local level, in a context where the innovation will have to prove itself feasible, accessible and of benefit to the target group. Adaptation includes elements of trial and error, interactive learning and feedback between actors, and therefore of changing the original idea (Gildemacher and Wongtschowski, 2013). After successful adaptation the next step is for an innovative solution to be disseminated to the actors intended to adopt it, involving a process of solutions “being put into routine use” and thereby becoming innovations (ibid.).

3.2.4 Pro-poor innovation

The study applies the Innovation Systems Perspective with a special focus on the effects of innovations on poverty reduction. This pro-poor focus remains central throughout the analysis of the findings. It includes on the one hand the impact of particular innovations, but also the way in which the innovation system itself is, or can be made, accessible, inclusive and participatory for the poor. Aiming to enable pro-poor innovations, the study therefore identifies, assesses and distinguishes, from the beginning, the systemic determinants and components of the innovation process (see Part I: 4.1 Research areas), with regard to successful innovation in general, and more specifically with regard to the possibility of enabling the poor to participate in and gain from innovation processes. It thereby expands on the ISP, adding another dimension of analysis and evaluation. Following Berdegúe (2005), “a pro-poor innovation system could then be defined as a multi-stakeholder social learning process, that generates and puts to use new knowledge and which expands the capabilities and opportunities of the poor” (Berdegúe, 2005).

3.2.5 Innovation Ecology and Innovation Systems

In its analysis, the study drew a distinction between an innovation ecology and a problem-focused innovation system (Metcalf and Ramlogan, 2008). Its main purpose was to assess the overall innovation ecology of the ALV subsector in Kenya. The term innovation ecology refers to the systemic determinants of all innovative processes and activities that can take place in a given economic sector. It is usually national in scope and includes all relevant actors, their interactions and relationships, as well as factors from the general political, cultural and socio-economic context, such as institutions, laws, perceptions, business practices and cultural values that affect the sector and its actors’ innovative potential. The innovation ecology is therefore a more permanent theoretical conception of all kinds of innovation processes and the context they take place in, similar to the natural sciences’ conception of the ecology of an entire ecosystem.

A problem-focused innovation system, in contrast, is transient and constructed by the process of connecting the relevant actors of the ecology in a way that enables a specific problem to be solved, e.g. access to urban markets by farmers in remote rural locations. Problem-focused innovation systems can be constructed on a local level, addressing very specific value chain problems, but can also cut across levels or even national boundaries, for instance tackling specific policy constraints to innovation.

The study's findings assess the overall innovation ecology of the Kenyan ALV sector with regards to determinants and potentials of pro-poor innovation, meaning the actors, their interactions, the institutional framework and context factors (see Part II Findings and Analysis). A concluding excursus on application will focus on a specific problem identified in the study, highlighting the difference between an overall assessment of the ecology versus analysing and modelling a specific innovation system, and identifying relevant actors, specific interactions and context factors that need to be targeted in order to solve the problem.

4 Methodology

4.1 Research areas⁵

To analyse the determinants, opportunities and challenges for pro-poor innovations in the horticultural sector of ALVs in Kenya, i.e. to assess the innovation ecology of ALVs, the Innovation Systems Perspective has been adapted to the study context and operationalised according to Malerba's (2002) innovation system framework, identifying four major research areas, Figure 2.

(1) The institutional framework and context factors, including political factors as well as socio-economic context, (2) trends in the ALV value chain, (3) the actors, including their function and influence, interests, resources and ALV priorities, but also their needs and challenges, and (4) their interactions and linkages, including the transfer and management of knowledge and resources, their collaborations and power relations. These research areas are described in further detail below.

4.1.1 Institutional framework and context factors

As outlined in the conceptual framework of the ISP, institutions, laws, policies, cultural values and other socio-economic context factors such as access to infrastructure, funding or structural inequality affect actors' behaviour, resources and priorities and therefore their ability and willingness to cooperate and interact in a given innovation system. The institutional framework and other contextual factors therefore become important preconditions for innovation processes. The study looks especially at (1) the emphasis that relevant institutions and policies place on the promotion of horticulture and ALVs on the one hand, and of specific pro-poor programmes on the other. This analysis is carried out in relation to an assessment of the overall agenda and priority-setting of these institutions and policies. In addition, (2) the study looks at the extent to which actors in the value chain have access to the socio-economic resources necessary for participation in innovation processes. This helps to assess the overall conduciveness of context factors to (pro-poor) ALV innovation.

⁵ See also the Impact Matrix in Annex 8.

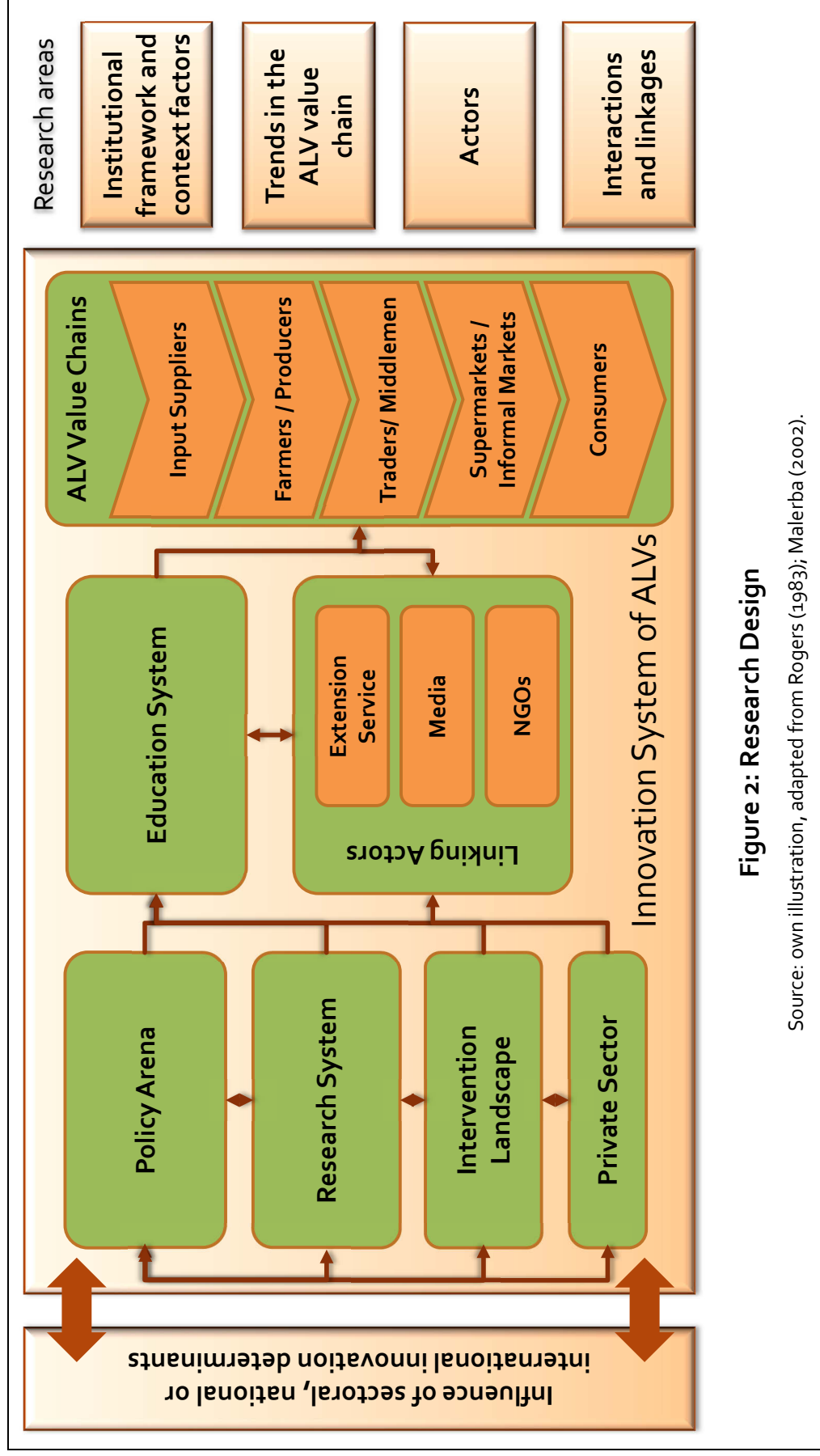


Figure 2: Research Design

Source: own illustration, adapted from Rogers (1983); Malerba (2002).

Policies can only be as effective as the institutions and individuals that implement them. It is necessary to explore the interests of political stakeholders (groups and individuals), and the opportunities and obstacles these stakeholders present for the development and implementation of political frameworks that promote pro-poor innovations in the ALV subsector.

4.1.2 Trends in the ALV value chain

In order to understand the ALV subsector, including its context factors, the actors and their interactions, as well as to identify diverse needs and opportunities for innovation, the study's assessment of the innovation ecology starts by describing and analysing the ALV sub-sector in relation to its evolution over the last few decades, its regional differentiation and its current economic dynamics. The study therefore analyses the ALV value chain, and identifies trends and challenges along the chain. Select innovations that for various reasons have either proven successful or have failed are presented throughout the findings in "innovation boxes".

4.1.3 Actors

The Innovation Systems Perspective is a conceptual framework that has at its core the analysis of actors, their functions, interests, capacities and weaknesses. In another research area it also looks at how those actors are linked and interact in innovation processes (see Part II Chapter 4). Actors, be they organisations or individuals, are the backbone and drivers of innovation. In the innovation process they fulfil a certain function or role, according to their strategic positioning, power, interests, priorities, resources and capacities. They can also potentially hinder an innovation process because of vested interests or an inability to participate because of a specific weakness, need or challenge. Depending on the innovation system, actors can have a varying roles, importance and influence regarding specific innovation processes. The study assesses these criteria for six groups of actors that have been identified according to their main function in the innovation process (Figure 2), namely: (1) The policy arena; (2) research systems; (3) education actors; (4) the intervention landscape; (5) linking (or intermediary) actors and (6) value chain actors, focussing specifically on farmers. In sum, the actor analysis not only assesses the actors' capacity and willingness to support (pro-poor) ALV innovation, but also identifies potential weaknesses that will have to be addressed in order to improve the overall ecology or a particular system.

4.1.4 Interactions

As argued above, actors and especially their interactions, linkages and relationships are at the core of the innovation ecology. Innovation is therefore essentially seen as a social process that involves actors collaborating with each other, transferring and managing the resources needed to innovate, learning from one another, and coordinating and sharing tasks for a common goal. After assessing the actors separately in a next step, the study focuses on the interactions taking place within the overall innovation ecology. In many cases it is the quality and quantity of interactions that determine the success or failure of innovation processes and therefore the ultimate impact an innovation can achieve.

Three aspects of interactions are considered in order to be able to assess the interactions multi-dimensionally. The first two look at the transfer of resources, such as information, knowledge, inputs or funds, that are essential to innovation. The study analyses what resources are transferred, how, between whom and for what specific purpose. The third dimension is concerned with how the actors' linkages and relationships guide and structure not only these resource transfers, but also the way actors influence each other, collaborate in partnerships and coordinate their functions within the innovation process. Interactions are discussed in reference to their functioning within the innovation ecology. In addition, they are assessed regarding their pro-poor potential and impact.

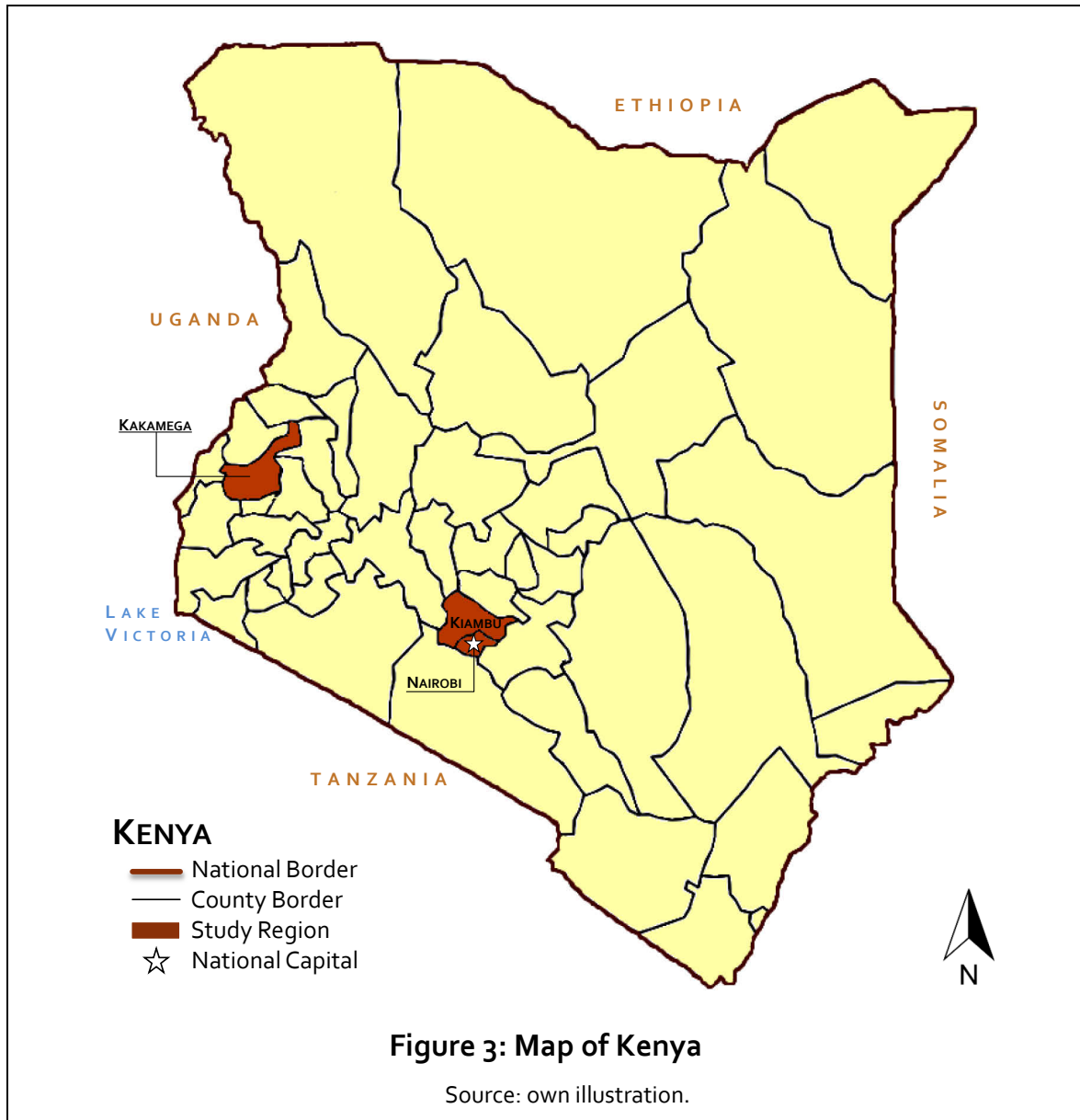
4.2 Empirical methods

The study takes an explorative approach in describing and assessing the innovation ecology within the four research areas described above. Since the focus lies on pro-poor innovations, smallholder farmers were given special attention in data collection. A regional focus lay on rural and peri-urban areas in Western Kenya, as well as peri-urban and urban areas in central Kenya to enable a regional comparison (Figure 3). A diverse range of interviewees from the six main actor groups identified above was selected in a process of iterative sampling.

The study employed an approach of theoretical sampling to identify all relevant stakeholders in the innovation ecology through a series of iterative loops.

In the first step, actors in the innovation system at the level of national policy-making, in the intervention landscape and among research institutions were identified through desk research and preliminary consultations with partners.

To guide the selection of additional actors at the regional and local levels the following first insights from data collection were taken into account. These were primarily farmer groups, but also NGOs, private actors and the media.



4.2.1 Data collection: individual interviews⁶

The study team conducted 44 individual interviews with experts and key stakeholders in order to assess the actor's roles in and perceptions of the ALV innovation ecology and to analyse their interactions and linkages with others. A semi-structured standard questionnaire (see Annex 2) was used and slightly adapted according to each interviewee's actor group (cf. Littig, 2013). The questionnaire covers all four research areas and served as a guide, but it was used flexibly by interviewers to give each interviewee the chance to develop their views in a more open and narrative way.



Farmer group interview. Ifwetere, Kakamega County

Photo: M. Elsen

At the end of each interview the informants were asked to theorise on the nexus between elements of innovation processes and the potential of ALVs to reduce poverty and nutrition insecurity.

6 See Annex 1 for the list of interviewed experts.

4.2.2 Data collection and stakeholder engagement

Two different kinds of group interviews were carried out, group discussions with around 130 individual farmers and two expert focus group discussions with extension officers and nutritionists.

Farmer group interviews⁷ (FGI)

Seven farmer groups were interviewed in Kakamega County, the primary field site. In the second field site, Kiambu and Nairobi counties, four farmer groups were interviewed.

The study team recruited and trained local facilitators to guide the conversations and ask the questions in the local languages, as well as observers to record what was said. Facilitators were briefed and trained individually before conducting the interviews and were provided with a list of questions (see Annex 4).



Training of local facilitators. Kakamega County

Photo: L. Gefäller

⁷ See Annex 3 for the list of farmer group interviews.

Thematic areas included innovations in ALV farming, sources of agricultural information, types of collaboration in groups and the role of different providers of advisory services, the private sector, government and other actors.

To make contact with farmers, assistance was sought from researchers at KALRO and JKUAT who facilitated contact with extension officers.

Focus group discussions⁸ (FGD)

Two focus group discussions were conducted with groups of innovation actors that play a special linking role between the value chain and other actors in the innovation system, principally the farmers. One such group was extension officers and the other nutritionists tasked with public health education. These groups were asked to discuss questions on their experience and were encouraged by members of the research team to engage in discussion among themselves, which proved not only fruitful but also somewhat controversial among the discussants (cf. Morgan, 1997; Hennink, 2007).



Presentation of the study's preliminary findings. Nairobi

Photo: J. Emmy

⁸ See Annex 5 for the list of focus group discussions.

Stakeholder Meetings⁹ (StM)

Over the course of the research process, the team conducted a total of three meetings. The meetings served the dual purpose of engaging stakeholders and gathering data. The first meeting brought together key HORTINLEA researchers.

The second stakeholder meeting, which took place at the annual HORTINLEA meeting in Nairobi, included both German and Kenyan leaders of most HORTINLEA subprojects as well as German and Kenyan development practitioners. Here, participants discussed ideas towards practical application of research results and broader collaborations and partnerships beyond research activities.

Finally, the presentation of the study's preliminary findings in Nairobi to Kenyan stakeholders from research, NGOs, donors and policy-makers was used to raise stakeholders' awareness of the common challenges they face regarding the relevance and utilisation of research, as well as to highlight the innovation systems approach to participants as possible future members of the ALV innovation platform. Data gathered in all three stakeholder meetings was analysed in the same way as that from the other interviews.

4.3 Data analysis

Primary data collected for this study was exclusively qualitative. It includes observation memos written by the researchers (in some cases together with the facilitators of group discussions), transcripts from recorded individual and group interviews as well as focus group discussions. All primary data was coded using the software MaxQDA.

The last stage of analysis was a process of triangulating primary data with secondary sources when applicable, especially in cases where the collected data had to be supported, e.g. with macro-economic figures.

Importance-Influence matrix¹⁰

For the actor analysis, and especially in order to compare actors' potentials to positively shape innovation processes, the study uses the "Importance-Influence Matrix" tool. Quite simply, the influence of actor groups is plotted in a two-dimensional matrix against their importance for innovation processes. To identify the *important* actors, they are assessed by their target group orientation and ALV fo-

⁹ See also Annex 6.

¹⁰ Part II: 3.7 Results of actors importance and influence matrix.

cus. *Influential* actors are defined as those who are able to control decisions, exert influence on other actors and possess specific resources. Criteria for this second dimension are decision-making and coordination power, image and external perception, financial resources and access to infrastructure, human resources and institutional knowledge, networking and collaboration potential, and lack of special resource needs.

Part II: Findings and Analysis

The second part of the study lays out the empirical findings from individual and group interviews with different groups of actors in the innovation ecology. Findings within the four research areas – context factors, ALV value chain, actors and interactions – each receive a separate chapter. Each is first described and then analysed with respect to determinants of pro-poor innovation. The following fifth chapter in Part II draws together the individual analyses to provide a holistic and systemic assessment of the overall ALV innovation ecology.

1 Institutional framework and context factors

This chapter opens the assessment of the innovation ecology by analysing those determinants for innovation processes that relate to the political and socio-economic context. Political frameworks and institutions regulate the capacities of actors to participate and collaborate in innovation processes, especially public organisations and those partnering with them. They also often set priorities and thereby guide the actors' activities. The emphasis that agricultural policies put on horticulture, and on ALVs in particular, is crucial to the direction research and information activities take and is therefore a precondition of successful (pro-poor) innovation.

In addition, the prevalent socio-economic conditions influence the access of participants in the value chain to resources necessary for successful innovation, such as the human capacities, physical infrastructure and investments needed to increase and commercialise production.

1.1 Political factors

This section reviews relevant policies on agriculture in general, the effect of devolution on agricultural policy, the provision of advisory services and nutrition security as a specific policy issue. The focus throughout is on factors that can benefit or hinder pro-poor innovations in the ALV subsector.

The political environment in Kenya has been described briefly in the first part of this study. To make sense of the practical relevance of the policies reviewed here within that context, each of the following sections looks at the stated aims of particular policies, as well as their prospects for effective implementation.

In 2008, the Kenyan Government developed a long-term blueprint dubbed “Kenya Vision 2030” (hereinafter referred to as “the Vision”, cf. GOK, 2007). The Vision proposes to transform Kenya into a middle-income country by 2030. Increasing agricultural incomes is a stated aim under the heading of economic development, alongside the industrialisation and development of the service sector. The latter two receive a more prominent mention, however. Overall, the Vision does not have a clear focus on poverty reduction, as most of the proposed interventions seem to aim at the overall goal of GDP growth. In addition, it does not mention nutrition security as an issue, even though the Millennium Development Goal for eradicating hunger is being placed high on the agenda.

1.1.1 ALVs in existing agricultural policies

Kenya’s agricultural spending is still below the pledged amount of the Maputo declaration (also see Part I Chapter 2.). In practice, this means that the funding situation of public institutions in the agricultural sector is well below internationally agreed-upon requirements, necessary for sustained and broad agricultural growth that benefits the poor (Exp9). The general direction of current agricultural policies in Kenya is to commercialise with the aim of adding value to the economy. Accordingly, it is high-value export crops such as cut flowers that are being prominently promoted. Smallholder farmers are targeted and encouraged to increase their income through specialisation. The potential of horticulture to contribute to nutrition security is not fully realised.

Accordingly, the level of priority that ALVs receive within horticultural policies also lags behind. An interviewee from the parastatal company Simlaw Seeds reports “not having seen a lot of push on ALVs from the government” (Exp4). Although a policy for underutilised crops has been developed, its focus on ALVs has not been mainstreamed throughout general agricultural policy and therefore has not had a significant impact regarding implementation of measures in support of promoting ALVs (Exp11).

Another important function of the national government with regards to innovation is standardisation and quality control of crops and services through the Kenya Plant Health Inspectorate Service and the Kenya Crop Directorate (Exp4). Interviewees from the NGO sector hinted at governmental agencies being lobbied by the private sector to enforce favourable policies (Exp13). Consequently, the regulations may inhibit pro-poor innovation transfer, e.g. farmers’ local seed banks (see also Part III).

1.1.2 Devolution

The devolution process currently taking place in Kenya was initiated with the ratification of a new constitution in 2010. This restructuring of government institutions is highly relevant to the ALV subsector, as agriculture was placed almost entirely within the portfolio of the 47 newly-formed and directly elected county governments. Among other things, the implementation of extension services and agricultural training centres have become responsibilities of the county governments, in addition to setting priorities within the agricultural portfolio. The development of new policies, however, is still the prerogative of national government, which is also responsible for increasing the capacity of county executives as needed (Exp23).

Interviewees' perceptions of the process varied greatly, as did their assessments of its success so far. Interviewees aligned with the private sector saw it as an important step away from too much centralisation of government, bringing the potential to deliver services more directly, if corruption was controlled (Exp23). Respondents from research and NGOs criticised the increase in bureaucracy and a newly-created potential for corruption in the increased number of government offices (Exp3; Exp21). Francis Muthami, the National Coordinator of KAPAP, agreed with the process in principle but saw problems in the resulting lack of standardised implementation of policies:

You see, the counties [...] they will behave differently in agriculture because [when] you go to county (A) they have different approaches to extension, when you go to (B) they are totally different approaches, now that's a major challenge, there ought to be some kind of standardisation and also quality assurance.

Regarding the specific issue of agricultural policies after devolution, the picture was equally divided. One expert from the education sector saw the mandate of county governments to focus on the specific agricultural potential of each region as an important chance (Exp30), which would be relevant to the promotion of innovations in the ALV value chain in counties where they become a priority. A county policy implementer pointed out that the county governments were so far not endowed with a sufficient budget nor the human resources to carry out the wide-ranging responsibilities they had taken on (Exp23) (see also Part II Chapter 3).

1.1.3 Extension policy

As an effect of devolution, the provision of agricultural advisory services is centrally regulated in the new National Agricultural Sector Extension Policy (NASEP), while the extension officers themselves are supervised and managed by the county governments (Exp22). NASEP was formulated in 2012 and attempts to deal with

the low overall capacity of the extension service, as it is understaffed. In addition, the policy seeks to structure service provision, after the liberalisation of extension services. The government assumes the responsibility to coordinate different providers like private companies as well as NGOs. In practice, however, this coordination is not always effectively carried out, as reported by interviewed extension workers (FGD1) (see also Part II: 4.3.2 Collaboration and coordination).

In its mandate to provide technical assistance to the counties, the national government is currently planning to set up the Kenya Forum for Agricultural Advisory Services (KEFAAS), which will aim to coordinate stakeholders in extension service provision at the national level (Exp22). The KEFAAS initiative is part of a broader push by the National Government to implement NASEP, which includes formulating guidelines for implementation, building the capacity of County Governments and providing technical assistance. It remains to be seen whether this will contribute to increasing the reach and quality of available agricultural advice.

1.1.4 Food Security and Nutrition Policies

Kenya's National Food Security and Nutrition Policy extend the focus of food security to nutritional security (GOK, 2011b). In emphasising the aspect of nutritional quality, the Ministry of Agriculture (MOA) collaborates with the Ministry of Health (MOH) and international organisations. This means that vegetables should receive more attention in securing nutrition security than before, where the focus was mostly on using cereals to improve food security. One crucial issue highlighted by a high-level interviewee from this policy field was that preservation of vegetables should be supported at the county level to ensure continuous availability of nutritious food throughout the dry seasons (Exp23). However, according to nutritionists¹¹ charged with outreach at the county government in Kakamega, this policy area remains somewhat neglected and underfunded (FGD2). This observation confirms the low priority of nutrition security in the Vision 2030 (see above).

1.1.5 Governance and political space

International surveys show that corruption is very prevalent in Kenya¹². Interviewees were very reluctant to speak about this subject, however, presumably because it is a sensitive issue. In relation to innovation processes, corruption can negatively affect collaboration between actors in the system, for instance when

¹¹ Governmental departments of nutrition and home economics of the MOH and MOA, Kakamega County.

¹² Sources: Foreign Policy Magazine 2014; <http://foreignpolicy.com/2014/05/06/everyone-is-corrupt-in-kenya-even-grandmothers/>.

government services are only delivered in return for the payment of bribes or when the competition for the best economic solutions along the value chain depends on actors' personal connections rather than on the innovativeness of the solution.

Some expert interviewees, namely a researcher and an NGO worker, mentioned tribal divisions as an issue in the support of smallholder agriculture in Kenya. For example, the use of one vernacular language in conveying agricultural information would raise suspicions in areas where a language is spoken that is aligned with a different political camp (Exp7).

1.2 Socio-economic context factors

According to innovation system theory, the existing infrastructure and available natural, financial and human resources form an important part of the structural conditions that can either inhibit or facilitate innovation processes.

The extent and depth of exchange and collaboration possible between farmers, researchers and other actors depend, for instance, on the means of communication that are accessible to and/or used by them. In addition, the ability of value chain actors to adapt an innovative technique, process or form of organisation often depends on the physical infrastructure (markets, roads and means of transportation) available to them.

What is more, ownership of sufficient land is an elementary precondition for innovation, and for investment in improving production through innovations. Financial means are necessary for some types of innovations, therefore the availability of credits or other financing or support schemes also matters. Finally, human capital also determines the capacity to innovate, above all the level of education. Social capital and networks as other important resources for innovation are described in the actors chapter.

1.2.1 Infrastructure

The state of Kenya's general infrastructure is described in the first part of this study, Chapter 2: Background. Communication and transport infrastructure are especially relevant for pro-poor ALV innovations, as they form the basis for information exchange and marketing. Their current state and potential impact on innovation is analysed below.

Communication

Relevant means of communication that require infrastructure include radio, television (TV), mobile telephony and the internet. There are many vernacular radio stations across Kenya, which enjoy great popularity, especially among farmers (Exp3; Exp13). 8 out of 11 group interviews with farmers mentioned the radio as a source of agricultural information, implying they had access to it. Therefore, it can be assumed that the basic infrastructure (i.e. shared receivers) is in place. TV was mentioned to a lesser extent, but the fact that an individual programme was very well-known speaks to its popularity and regular reception (Exp24).

New means of communication, such as mobile phone or internet-based services for agricultural information, were mentioned very infrequently. In particular, poorer and middle-aged to elderly farmers in rural areas lack access to these media (FGI8). This indicates that access to such means of exchange has not yet penetrated the rural areas of Kenya to a large extent. In addition, not even extension officers were equipped with the necessary electronic devices to facilitate the new service of e-extension in Kakamega Central (FGD1). Internet connectivity and access to digital journals was mentioned as a problem even for students at Bukura Agricultural College, which notably trains extension staff (Exp30).

Two enterprising middle-aged farmers in peri-urban Kiambu who were well-versed enough to seek out information through digital channels were an exception to the situation described above (FGI9).

Transportation

Insufficient road connections and low coverage of public transport in rural areas not only affect the economic outlook of farmers (as described in the previous chapter) but also the accessibility of information. In particular, agricultural field days, which were mentioned by almost all farmer groups as important sources of new information, cannot be accessed if they are too far away (FGI8; FGI5).

In conjunction with the government extension service's severe shortage of funds (cf. Part II: 3.6.1 Governmental extension service), the problem of transport caused farm visits to become more costly (FGD1). In other words, extension officers will charge money for their visits that is neither an official fee nor readily affordable by poor farmers. In turn, farmers' access to the knowledge provided by the government extension service depends to some degree on the distance from their farm to the local extension office, the quality of the roads connecting the two and the funds at their disposal (FGI8). Private advisory service providers are

better equipped with means of transport and therefore have easier access to farmers (FGD1).

1.2.2 Access to land

The availability and affordability of agricultural land in Kenya is a major issue for innovation processes. This is mainly because agricultural land is subdivided into very small plots. This is due to historical developments and current governance, as speculation on land and illicit acquisition of large portions of land by members of the political and economic elite continues to this day. Around the growing urban centres, prices for construction plots are rising and are rendering agricultural land less profitable in comparison. This has led to conversion of peri-urban agricultural land to commercial use where new estates are being built. What is more, the inheritance rules of many cultures in Kenya involve dividing the land between all children. Therefore, land portions in individual ownership have been split up into many areas (Exp5; Exp16). Inheritance-based subdivision has resulted in commercially non-viable agricultural practices.

Scarcity of farmland and especially small plot sizes raise the comparative costs of investments for innovations and even for farming inputs. Some input producers have started to adapt to the trend and are trying to supply their products in small quantities (Exp16).

In addition, land is distributed very unevenly among men and women in Kenya, which especially affects the prospects of ALVs. As one interviewee from the county government of Kakamega put it:

The bottleneck for African indigenous vegetable growing is the land tenure system. The shambas (fields) are owned by the old (grandfathers), but the African indigenous vegetables are grown by women (FGD2).

An unequal distribution between men and women of decision-making power on the one hand and day-to-day responsibilities in the production process on the other potentially limits the optimum use of existing knowledge and the development of innovative solutions.

1.2.3 Access to finance

Actors depend on financial resources to implement innovations, to disseminate knowledge and to consult with others during research. Most interviewed farmers reported a lack of financial means to invest substantially in improving their production. Although many items mentioned, such as greenhouses, are

among the more costly improvements for smallholders, a lack of capital affects many types of innovations, holding back progress.

A report for the African Development Bank (ADB) confirms this issue for the whole country: "in Kenya, the lack of capital and access to affordable credit is cited by smallholders as the main factor behind the low productivity in agriculture" (Salami, et al., 2010, p. 22). However, other reports also show that Kenya is the highest-ranking African country in terms of availability of micro-finance.

Researchers from international institutions, such as German universities collaborating within the HORTINLEA project and an international agricultural research centre, reported not having the means to consult with farmers on a broad basis (Exp1; Exp8; Exp12; Exp30; Exp34). National researchers mentioned a lack of funding for research and dissemination activities. These shortages were not expressed as individual problems but as a general issue with the availability of funding for communication activities in project budgets.

2 Trends in the ALV value chain

This chapter describes the evolving role of ALVs as a consumer item, outlining the increased demand over the last few decades and identifying market potentials. In the following, the ALV value chain is described and current challenges regarding the production, post-harvest, marketing and consumption stages are highlighted. These problems are then differentiated between more market-oriented and more subsistence-centred production. The following chapters refer back to selected problems along the value chain identified here and name innovations that solve them. In other words, the value chain is described here with a focus on opportunities for innovation wherever there are economic needs for inventions that would optimise processes and maximise output. This provides the context for the actors and interactions chapters in Part II.

2.1 Increased demand for ALVs

According to an overwhelming majority of interviewees from research, policy and civil society there has been a marked rise in demand for ALVs in Kenya over the last twenty years and many saw the demand as still increasing today. Another broadly agreed fact was that the universal availability of the product in formal and informal markets was a fairly recent development.

Many interviewees, especially farmers in central Kenya, cited an earlier period when ALVs were seen as a “poor man’s crop” (FGI10). Some researchers and NGO experts explained this with reference to the colonial period, when the government had discouraged the production of “backward” ALVs and instead promoted high-value export crops and exotic vegetables as “developed things” (Exp3; Exp7). However, other interviewees date the period when ALVs were replaced by exotic varieties such as cabbages as more recent, i.e. one generation ago. According to nutritionists in service of the county government of Kakamega, it was after independence that exotic vegetables were promoted as “modern” (Exp22; FGD2). In any case, the “renaissance” of ALVs might be related to the search for a genuinely Kenyan identity as a reason to see positive value in traditional food crops (Exp7).

It is against this backdrop of a previously low demand for ALVs (be it more or less recent) that the image of ALVs has changed from negative to generally positive throughout most of Kenya during recent years. This seems to have been a complex process that varied regionally and related to a combination of factors which are explored below.

2.1.1 Changing perceptions of ALVs

Regional differences

This study found differences in perception of ALVs between the research sites in Kakamega (a mostly rural county in Western Kenya) and Kiambu (a peri-urban county in central Kenya). Therefore, perceptions in the two locations are described separately and compared below.

In Western Kenya, ALVs are deeply rooted in the local cultures. Here, some farmers stated that ALVs had always been a part of their diet and that they had never been neglected. Farmers reported their ability to collect ALVs from the fringes of their farms without having planted them, as they grow wildly (cf. FGD2). Because of this, farmers in Western Kenya do not always see them as a commercial crop:

We see them grow by themselves and we pluck them, we eat them because they are vegetables, so that has been a continuous mode which has seen these vegetables grow around there. Each time we harvest maize, they spring up, no one plants them then we use them as vegetables (FGI2).

In central Kenya on the other hand, the recent surge in demand was more pronounced because the previous shift to exotic vegetables was more comprehensive. While ALVs are in high demand in the markets of central Kenya, they are rarely grown by small-scale farmers for home consumption. Those who do grow them, do so primarily for the market (Exp22).

This renaissance of ALVs in central Kenya was in one location directly attributed to a large migrant community from Western Kenya that had settled in a suburb of Kiambu Town and was driving a strong local demand (FGI9). Another influence cited by a number of experts from the policy arena was the proximity of producers in central Kenya to the urban centre of Nairobi. According to government and NGO campaigners, members of the urban elite act as trendsetters in consumption patterns for rural populations. Therefore, the increase in demand for ALVs in the peri-urban areas of central Kenya is more uneven, more dynamic and has an influence on rural populations elsewhere (Exp3; Exp23; FGD2). In addition, rising demand in the context of urbanisation supports and necessitates tighter competition in the market and more commercialised, larger scale production (Exp23).

Health benefits

Interviewed farmers and interview partners from all actor groups across the study regions unanimously cited ALVs being very nutritious as a reason to grow and consume them. This was supported by views on various medicinal uses of dif-

ferent varieties, one example being African Nightshade, which is used to treat a range of ailments from chest pains to forgetfulness (FGI11).

Interviewed farmers also often mentioned that local health professionals recommended consumption of ALVs as an element of a healthy diet, e.g. Amaranth and Spider Plant against a “shortage of blood”¹³ (FGI2). This was confirmed especially with regards to people living with HIV/Aids, who were recommended such a diet by doctors and started growing ALVs in their self-help groups (Exp33; FGI7).

The concern for healthy nutrition was described by some experts as a general trend of recent times: the Kenyan middle class are increasingly conscious of their health and therefore want to adjust their diet to avoid nutrition-related diseases (Exp23).

2.1.2 Recent ALV promotion campaigns

There have been several large-scale public outreach campaigns by coalitions of international and local NGOs and sections of the Ministries of Agriculture and Health to promote ALVs (Exp7; cf. Obel-Lawson, 2006). One of the campaigns, led by Bioversity International and run from 2001-06, produced different types of outreach material and held promotion events. It sought to promote the consumption of traditional foods including ALVs through raising awareness about their health benefits (Exp20). This choice of focus was reportedly related to an assessment of what urban target groups cared most about (Exp3). Another campaign carried out by the non-governmental Rural Outreach Programme (ROP) involved ALV cooking competitions to re-publicise traditional knowledge and promote consumption (Exp33).

It remains unclear whether changes in perception can be directly attributed to these outreach activities. However, it is striking that the wording of interviewees’ responses on the benefits of eating ALVs was often very similar across study locations. This is a possible hint at changes in perception induced by past campaigns.

Cultural perceptions and trends in consumer behaviour are contributing to an increase in the demand for fresh indigenous vegetables for home consumption and for prepared vegetables as food served in restaurants. However, in taking advantage of the opportunities presented by the market, producers (and potential producers), as well as other value chain actors, face related challenges.

13 Local description of anaemia, a decrease in the amount of hemoglobin in the blood.

2.2 Problems along the value chain

The value chain of ALVs is relatively short, as the bulk of the produce is purchased by the end-consumer mostly in an unprocessed, fresh state. In addition, the largest quantities are sold on informal markets by either the producers themselves or one single middleman or vendor. Middlemen usually purchase at the farm gate, transport to the market and sell. However, there is also a growing segment of bulk purchasers such as supermarkets, hospitals, universities, schools and prisons (Annex 7).

2.2.1 Inputs

Depending on the availability of water, it is theoretically possible to grow ALVs throughout the year. However, in the “ALV-hotspot” of Western Kenya, most small-scale production is rain-fed, which limits the growing periods to the two rainy seasons (FGI2; cf. also FGI6).

The supply of high quality seed of varieties adapted to local conditions and tastes was mentioned as a challenge by almost every single farmer group and many experts. Farmers also mentioned soil fertility as an issue, specifically the need for laboratory analysis of soil samples to adapt the use of fertilisers to the soil type. Such analysis, in turn, was reported to be too expensive due to limited availability of the service (FGI4). Therefore, most ALV farmers use either animal manure or generic chemical fertiliser from local stores. Often, they are unsure about what quantities to use. In Western Kenya, indigenous knowledge on the use of organic fertiliser is prevalent but transportation of manure is an additional challenge (FGI7).

Due to ALVs’ century-long adaptation to local ecological conditions, problems with pests and diseases are few in comparison to exotic vegetables but larger productions tend to be more affected (FGI9). In addition, farmers in Western Kenya were particularly reluctant to use chemical pesticides and herbicides for health reasons (FGI7), while traditional knowledge about organic pesticides is prevalent.

2.2.2 Production and Labour

ALVs are produced mostly in small-scale production in Kenya. Plot sizes and degrees of commercialisation vary greatly between farmers (Part II Chapter 3).¹⁴ The focus of this study lies on small-scale farmers facing poverty and malnutrition.

¹⁴ A large part of the produce sold in Nairobi comes from a few large-scale producers in Bungoma as well as in the Limuru and Athi river regions (Exp19).

Although the production, and especially harvesting, of ALVs is comparatively labour-intensive, labour was mentioned as a bottleneck by only one expert (Exp30). Farmers explained that they find help from their groups (FGI1) and did not highlight labour as a big problem. However, some farmers mentioned the ability of commercial producers to hire casual labourers when required as an advantage, for instance for the task of transplanting (Exp25; FGI7). This might imply that even farmers who are currently self-sufficient labour-wise would profit from the ability to occasionally hire additional labour to implement specific innovations. Timing of the harvest is identified as crucial to minimising losses (Exp19).

2.2.3 Post-harvesting and Processing

Keeping the vegetables fresh during storage or periods of transport to the market is a challenge for farmers and other value chain actors. In particular, lack of electricity, combined with a lack of on-farm cooling facilities, can cause large post-harvest losses. Local solutions to this problem are innovative:

You can go to a mother; mother, I want vegetables. [...] You'll go where she is going to get them from, you will see she has put down sacks very well, she has sprinkled water and has put leaves on top or banana leaves, then you will get them still fresh, at times you'll think they stayed in the fridge (FGI2).

However, this technique can generate new problems because too much sprinkling can cause mould to grow on produce (InnovRT).

Drying of ALVs as a relatively easy and affordable way of preservation and value addition was mentioned only very infrequently. One farmer group in Western Kenya had received training on drying produce but they were not currently practising it (FGI4). There is anecdotal evidence that the Kisii community supply members of their diaspora with dried ALVs (Exp3), but according to producers, consumers in Kenya generally prefer fresh produce over dried vegetables. Exceptions were cited by three farmer groups in Western Kenya, saying that in times of limited availability, consumers do buy them (FGI5). In addition, one enterprising farmer in Kiambu reported having given away dried ALVs free of charge, after which consumers came back for more (FGI11).

2.2.4 Marketing

The majority of small-scale farmers producing ALVs for the market either have their produce picked up by traders at the farm gate or take it to village or road side markets. Large-scale buyers such as supermarkets and restaurants, as well as school canteens, hospitals and prisons received much fewer mentions. These buyers mostly have fixed suppliers that they vet through different procedures (Exp19).

4.2 Trends in the ALV value chain

Market information

There are very few means for farmers to get information about market prices and demand. The demand, though described by most value chain actors as high, is still not perceived to be reliable enough for the majority of farmers to concentrate on commercial ALV farming (Exp23; Exp33). However, some more organised farmer groups reported conducting market surveys which helped them negotiate with middlemen (FGI4). For those farmers selling to middlemen, a lack of information about market and price dynamics, customer preferences, and possibilities of standardisation procedures (such as the use of scales) often lead to a situation that farmers describe as being exploited by their trade partners (FGI3; FGI8).

For formalised markets several factors result in high barriers to entry for small-scale farmers: high quality standards, continuous supply, requests for assorted varieties and vegetables with a long shelf life, delayed and bureaucratic payments, and farmers' obligation to take back unsold produce (vendor return) (Exp18; Exp19).

Another problem related to marketing is the timing of the harvest. Farmers who depend on seasonal rains often end up bringing their produce to the market simultaneously with many of their peers, which leads to oversupply and a resulting fall in prices (Exp19).

Transportation

Means of transportation to markets include walking, motorcycles and vehicles, either owned or borrowed. Unreliable means of transportation represent another major challenge, even more so for suppliers of the large informal vegetable markets in urban centres (Exp19). This challenge limits the marketing activities of individual farmers mostly to markets that are within 5 km of their farms (Exp26), as the returns are not sufficient to meet any additional transportation costs (FGI10). Another expert estimated one hour as the furthest profitable travel distance for individual farmers. Beyond this limit, the costs for transportation would become prohibitive (Exp3).

2.2.5 Consumption

While the widespread and expanding consumption of ALVs can be considered a good sign for the alleviation of malnutrition, some cooking practices nullify their great potential, reducing the content of many essential nutrients. Specialists reported that some vegetables are being cooked for long durations to make the taste less bitter, resulting in the vegetables retaining very little of their healthy components (FGD2). This practice is especially employed to sweeten the meal for children, who reportedly dislike the bitter taste of some ALVs, and it is done even in Western

Kenya where ALVs are a traditional and long established foodstuff (FGI₃). Here, information is lacking on how to prepare ALVs in a way that avoids these losses. In the case of two groups of farmers in one urban and one peri-urban location, members reported calling in a nutritionist on their own initiative in order to learn the proper ways of preparation (FGI₃; FGI₁₂). However, this initiative remains an exception in both study regions. A need for know-how also extends to the personnel of some of the large-scale canteens that serve ALVs, e.g. in schools and prisons (FGD₂).

3 Actors

The actors are the backbone of the overall ALV innovation ecology. Their capacities, influences and weaknesses must be taken into consideration for every policy, research and development programme targeting ALVs. Not all actors may be equally influential and suitable partners for collaboration (drivers) in a specific innovation system. It is also crucial to identify those actors who could potentially interfere with a policy, research or development programme (hindrances). Therefore the needs, challenges and vested interests of actors, especially the 'target groups' of the intervention, must be assessed in order to understand innovation bottlenecks as well as opportunities for improvement.

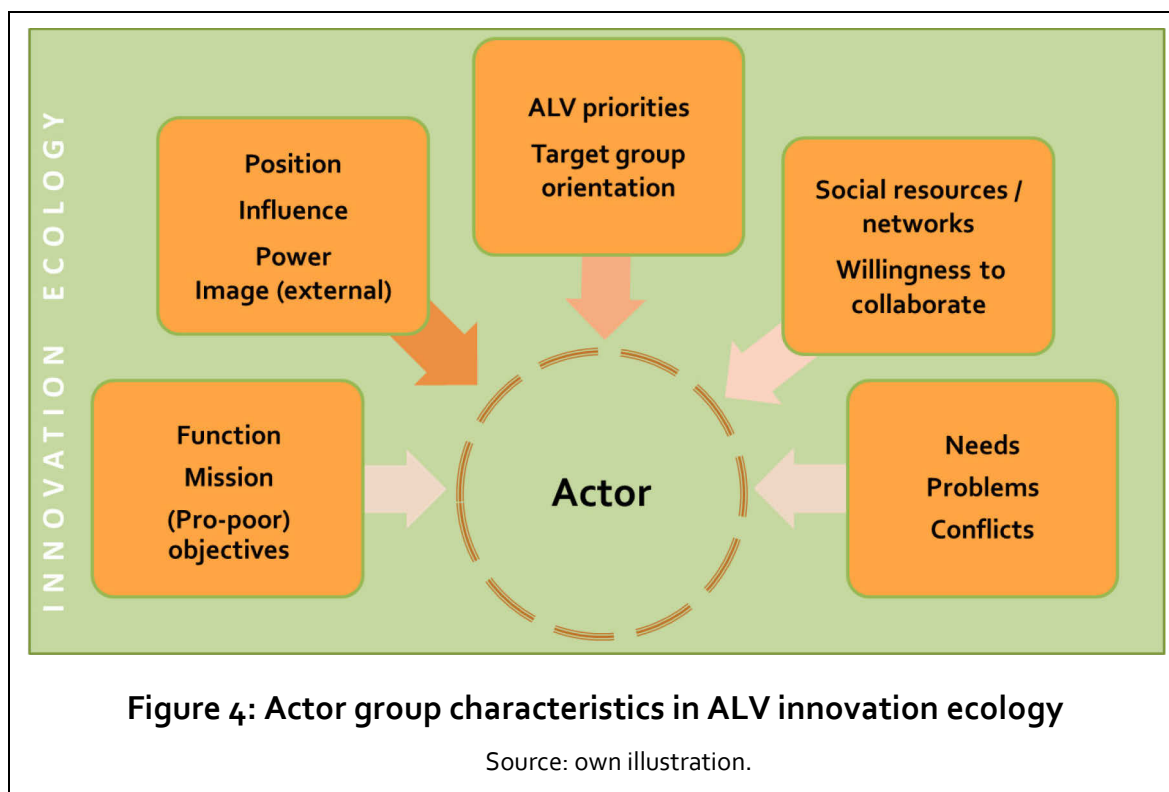
In the design and analysis of this study, six main groups of actors with relevant functions and roles within the ALV innovation ecology were identified:

- I. The Policy Arena
(The national government, the county governments and civil society)
- II. The Research System
(International Agricultural Research Centres (IARCs), the National Agricultural Research System (NARS) and academic research institutions)
- III. Education Actors
(Schools, universities and agricultural training centres/colleges)
- IV. Development Agencies
(Donors and NGOs)
- V. Value Chain Actors
(Subsistence and commercial farmers, input suppliers, traders and middlemen, consumers)
- VI. Linking Actors
(The governmental extension service, NGOs and the media).

There are also a number of other actors that may be relevant to the innovation ecology of ALVs, in particular financial institutions. As these have not yet been playing an active role in ALV innovation processes, they have been analysed rather as a socio-economic context factor with regards to their role providing resources to entrepreneurs (e.g. microfinance institutions providing loans to farmers) (see Part II Chapter 1).

Each actor's role, influence and importance in the ALV innovation ecology were analysed. Depicted in the diagram of the innovation ecology below, the following

characteristics were assessed and analysed for each actor group regarding their impact on ALV innovation processes (Figure 4).



In conclusion, this actor analysis describes potential drivers and facilitators of improved collaboration and innovation in the ALV innovation ecology. It also identifies the challenges actors face and potential hindrances that have to be addressed. For this purpose, an actor influence-importance matrix illustrates and compares key actors' importance and influence in the ALV innovation system (see Part II: 3.7 Importance-influence matrix).

3.1 Policy arena

3.1.1 National government

The Kenyan national government's main role in the ALV innovation ecology is the development of agricultural policies that ensure standardisation and quality control of crops, advisory services and agricultural education. As described above, the government's predominant policy paradigms regarding agriculture and horticulture are commercialisation and export orientation (see Part II: 1.1 Political factors). National efforts towards food security concentrate on staple foods and ex-

port crops, whereas crops mainly contributing to nutritional security have not yet become a priority (Exp21). The national government has produced well-designed agricultural policies, but several experts implied that a lack of capacity building, provision of technical assistance and funding to the counties are problematic, especially in regard to the devolution process. The national government is endowed with major financial and human resources (Exp20). However, the very small allocation to the agricultural sector within the national budget often makes it necessary for policy-makers to search for alternative funds from donors and the private sector. Several interviewees indicated that multinationals exert influence on policy making in favour of export goods. There is a gap between the Kenyan government's commitment in policy papers to target subsistence farmers and the actual support for commercial production focusing on export goods such as coffee, tea and cut flowers. The policy paper goals of achieving food security are mainly supported by the donor community. Civil society actors voice the concern that donor funds may rather hinder than advance the implementation of pro-poor programs, by creating an incentive for Kenya to continue to present itself as falling short of food security in order to remain eligible for donor funds (Exp14).

3.1.2 County governments

The county government's role within the innovation ecology is to implement policies on the county level. The devolution process currently taking place in Kenya should increase the executive functions of the county governments. Regarding ALV innovation processes, the devolution theoretically poses major opportunities for counties to prioritise on and exploit their regions' specific agricultural potentials. Especially in high potential regions such as Western Kenya, this is a chance to implement policies and programmes focusing on ALVs (Exp30). Until today, however, no systematic implementation of ALV programmes at the county government level has taken place. The engagement of individuals is necessary to promote ALVs at county level. However, these individuals need the county minister's consent for their programmes if they are to have an impact or be up-scaled. Several experts considered "*Following the protocol*" and seeking the consent of senior and high-level ministers to be crucial in the Kenyan context. This also applies to aligning external funds with the county's decision-making hierarchies to prevent corruption and the inefficient use of resources. At the county government level, ALVs have been promoted mainly by the governmental departments of nutrition and home economics of the MOH and MOA. However, these departments do not receive sufficient funds to spearhead large programmes supporting and subsidising ALV production and marketing. Thus, many experts recommended

facilitating collaborations between the ministries of agriculture, health and education to draw attention, and funds, to these crops.

Further potentials regarding ALV innovation processes result from the Kenyan system of governance in the counties¹⁵. The social resources of the county government are its proximity to the communities through this hierarchy and county ministers' high level of agricultural expertise. These resources account for the favourable external perceptions and trust towards the county government shown by farmers. Some drawbacks for innovation processes at the county level are also apparent. Levels of funding for human and physical resources, such as extension staff and their means of transportation, differ across the counties. Western counties seem to have fewer such resources than, for example, the county governments of Machakos or Kiambu Counties in eastern and central Kenya, respectively (Exp6). Delayed devolution of financial resources limits the scope of agricultural activities, reaching only a small number of beneficiaries. As a number of experts lamented, county governments' activities mainly remain concentrated around central towns.

3.1.3 Civil society

Civil society in Kenya can be differentiated into two actor groups. Their functions for the innovation ecology are, on the one hand, lobbying and campaigning for specific policy issues such as underutilised crops, and on the other hand, working directly with farmers, organising them or conducting agricultural trainings. The latter group comprises more rural-based actors from NGOs, farmers and faith-based associations and addresses practical farmers' issues, for example the *Kenya Farmers Association*, which distributes seeds (FGI4). Potentials regarding ALV innovation processes are civil society's proximity to poorer communities, as well as the extensive networks in rural areas (Exp25). In particular, churches have been identified as the starting point for many interest groups (FGD2).

In contrast, advocacy actors are organised in networks of organisations and varying individuals who raise land rights issues, participate in budget control and advocate for underutilised crops and organic farming¹⁶. To raise awareness about ALVs, civil society actors have successfully undertaken two campaigns. They are mostly donor-funded and experienced in collaborating with each other, e.g.

¹⁵ Counties are subdivided into constituencies and wards. Mobilisation of farmer groups functions through a long-established hierarchy from county to sub-county officers to village chiefs, making use of influential farmers and village *barazas* (FGI11).

¹⁶ Some examples of recent issues addressed by Kenyan civil society are multinationals' increasing influence on Kenyan politics in favour of Genetically Modified Organisms (GMOs), and potential barriers to pro-poor innovations such as the *Seed and Plant Varieties Act* (FAO, 2012) (also see Part III).

through the SACDEP network for organic farming or the Kenyan biodiversity coalition (Exp14; Exp21). Although they employ outreach staff, their headquarters are often based in the capital or in bigger towns. Regarding ALV innovation processes, the great diversity of civil society actors is not only a potential but also a hindrance, since it is difficult for any other actor to identify those civil society actors willing to support a particular innovation.

3.2 Research systems

The agricultural research institutions in Kenya comprise several systems with different missions and capacities for research and for outreach to farmers, namely the *National Agricultural Research System* (NARS), the *International Agricultural Research Centres* (IARC) and the national universities and their international collaborations such as HORTINLEA.

3.2.1 National Agricultural Research System (NARS)

The *Kenyan Agriculture and Livestock Research Organisation* (KALRO), until 2014 known as the *Kenyan Agricultural Research Institute* (KARI), is active throughout Kenya and across counties. Within the framework of the recent devolution, the institution is currently in a process of restructuring. In line with the national governments' prioritised commercialisation of agriculture, KALRO's mission and function in the innovation ecology is to support farmers in improving their productivity and their commercial abilities. KALRO is composed of sixteen semi-autonomous institutes established under the *Kenya Agricultural and Livestock Research Act of 2013*. It is financed through a mix of national allocations, multilateral funding and its own revenue from patents and breeders rights (KALRO, 2013), though funding for horticulture derives mainly from donors (Exp16). The organisation's mainstay remains staple crops and its approach to horticulture largely focuses on value-chain and market development. Charles Waturu, the director of the KALRO Horticultural Research Institute, mentioned a recent shift towards establishing more horticultural centres.

Regarding the promotion of ALV innovations, KALRO is the main Kenyan institution for promoting, streamlining, coordinating and regulating research in crops (KALRO, 2014). KALRO works in close collaboration with county governments, universities, the private sector, the media and NGOs and has experience working with innovation platforms including donors and international research. KALRO Kisii, Kakamega, Kitale, Mtwapa, Katumani and Thika have been named as some of the centres with a focus on ALVs, although their resources vary and they specialise in

different research areas. Although ALVs have been categorised as highly relevant to food security in a recent KALRO workshop, they are not prioritised on the research agenda (Exp11). ALV research within KALRO still depends largely on the interest of individual researchers.

According to the KALRO staff's self-assessment, their high legitimacy and continuity as a governmental institution is diminished by their lack of resources, including human resources. A job freeze over more than two decades, coupled with a lack of opportunities for further training and career development for KALRO staff, has caused an on-going brain drain of experienced staff to universities (Exp16). This lack of human resources also severely limits KALRO's potential to collaborate sustainably with other actors. KALRO also lacks physical resources, such as farming and research land, which has been privatised and acquired by a few individuals, and for which the organisation is now trying to claim reimbursement. Finally, a lack of financial resources for means of transportation or for other outreach activities limits KALRO's potential to work directly with extension services and farmers (Exp32). However, there are dissenting views from outside KALRO that hint at over-funding on the part of donors, who attach few conditions to funding, thereby removing the incentive to allocate resources efficiently. An additional criticism is that resource allocation for non-commercial crops is largely carried out without the participation of farmers. Unless needs assessment is performed systematically, farmers' access to KALRO input supplies and research results depends largely on their individual interests, capacities and proximity to each institution, potentially excluding poorer families in remote areas (FG11).

3.2.2 International Agricultural Research Centres (IARC)

The International Agricultural Research Centres (IARC) are comprised mainly of the fifteen institutions of the *Consultative Group on International Agricultural Research* (CGIAR), the *International Centre of Insect Physiology and Ecology* (ICIPE) and *The World Vegetable Center*¹⁷ (AVRDC). The mandate of the IARCs and their functions in the innovation ecology are to alleviate poverty, increase food security and promote the sustainable use of natural resources. A multi-donor trust fund finances research carried out by the centres (CGIAR, 2014).

Compared to the NARS and the universities, the IARCs have sufficient financial, physical and human resources to meet their objective of conducting high quality research for development. In some of the centres, ALVs are given high pri-

17 Previously known as the Asian Vegetable Research and Development Center.

ority, as is the case with the AVRDC (Exp8). With Nairobi being a science hub for sub-Saharan Africa, their presence in the capital of Kenya is a huge potential for ALV innovation processes. It is, however, important to differentiate among them. There are IARCs that have already embraced a more inclusive systems perspective, searching for ways to make their research more demand-oriented and to put their results into practice. Other centres focus only on more “traditional” approaches to research, without an emphasis on linking up with farmers (Kenya, 2007, p.5). An expert described the IARC structure as at times “a pretty closed society”, and proposed “granting more access to people from the local level to the IARCs, where high-end research is conducted” (Exp5). A recent study looking at how to bridge the gap between research and practice showed that the most important problems of farmers are not addressed in many centres’ research (Bachmann et al., 2014). Reasons given by respondents were centres’ poor partnerships with other organisations and farmers for needs assessments and up-scaling of good practices. This can partly be attributed to a research system where researchers are still being rewarded mostly for scientific publications instead of engagement with farmers’ organisations, extension services or NGOs (Exp8; Exp11).

3.2.3 Academic agricultural research institutions

Academic agricultural research institutions consist of national universities and their national and international collaborations. The academic agricultural research institutions’ main functions within the innovation ecology are agricultural research and to some extent education and training (see also Part II: 3.3 Education actors).

The following strengths and weaknesses have to be taken into account in regard to ALV innovation processes. The large presence of agricultural universities in Western and central Kenya predestines them to set regional priorities in research and to serve as outreach centres for farmers regarding the ALV subsector (Exp11). This favourable geographical spread is complemented by many universities’ emphasis on two-way exchanges with farmers. Multiple formal and informal ways to link up with farmers exist, and many professors and students have quite a clear idea about farmers’ thinking, problems and needs. Professors enjoy high esteem and the freedom to venture into specialised areas, which results in increasing numbers of individual researchers publishing about ALVs. The professors Onyango and Abukutsa are two names that have repeatedly been described as champions promoting ALVs for more than twenty years. These highly engaged individuals and their academic networks are generally sustainable because of the long-term commitments of researchers working in one particular field, and their exchange with many other actors in the ALV innovation ecology, e.g. the NARS (Exp10; Exp20;

Exp33). Kenyan universities collaborate with international universities, e.g. Michigan University in the USA, Nagasaki University in Japan, or the Humboldt-University of Berlin in Germany. They also link up with East- and pan-African universities through the *Inter-University Council of East Africa* (IUCEA) and the *Association of African Universities* (AAU) (Kenya, 2007, p. 4). However, some experts lament that no central coordination unit ensures that they complement, rather than compete with, governmental extension staff activities and the contents of agricultural programs (Exp15; FGD1). Such coordination would also prevent duplication of research endeavours (see also Part II: 4.3.2 Collaboration and coordination). Third-party funding, and therefore national and international networks, largely influence the institutions' funding. Therefore, their capacities and resources differ substantially from institution to institution.

3.3 Education actors

The education sector consists of universities, middle-level agricultural training colleges/ centres and schools. Their function in the innovation ecology is to train future agricultural professionals, especially extension officers, but also farmers themselves. Embedding ALVs into the curricula of universities, agricultural training colleges and schools was identified by many interviewees as the most sustainable way to promote them.

Universities

Several professors have started individual efforts in curricula development at university level, e.g. Professor Mary Abukutsa at Maseno University and Jomo Kenyatta University of Agriculture and Technology. However, comprehensive, nationwide programmes to incorporate ALVs into curricula have yet to be undertaken. Many interviewees lamented the absence of collaboration with and participation by the Ministry of Education (MOE) in relation to agricultural education and training. Improving collaboration between the ministries and other actors in the innovation ecology may be an important step toward further curricula development and the promotion of ALVs as a nutritional and healthy alternative (Exp3; Exp20).

Mid-level agricultural colleges

The Bukura Agricultural College in Kakamega is the only mid-level agricultural training college in Kenya. It is financed by the national government. Its objective is to train future extension officers and other agricultural professionals in two-year diploma courses. It also acts as a linking institution between research and extension.

Its mission of agricultural training is inclusive, incorporating farmers', students' and extension officers' views in curriculum development in a two-year review cycle. ALVs have so far not been emphasised in the curriculum, and resources to update the courses to the latest levels of research are lacking (Exp30).

Agricultural Training Centres

The Agricultural Training Centres (ATCs) operate at the county level and their objective is to train farmers directly (see also Part II Chapter 4). They are financed directly by the counties they serve. There are 27 ATCs across the country, and several more are being established (Legal Notice No. 33, 2014, pp. 196-198). The Bukura ATC serving Kakamega and Vihiga County was the only one researched for this study. It acts as an outreach centre by offering advisory services, farmer field days and demonstration fields, where agricultural practices are taught. Several farmers praised the training events (FGI1; FGI8). However, the centres' outreach capacities are limited. Therefore, which farmers are selected for training depends on the choice of the sub-county or extension officer in charge. Farmers from remote areas or without the means to pay for transportation to the training centre do not have the chance to attend training events as often as others.

Schools

Primary and secondary schools are places with a huge potential to teach the younger generation about the agricultural potential and nutritional benefits of ALVs, a process that has already been initiated by several NGOs. Targeting youth through the education system presents a great opportunity to regain lost ground for ALVs because the current generation has little means of acquiring the knowledge that was traditionally passed down by grandmothers before the increase in youth migration to urban centres (Exp7; FGD2).

3.4 Development agencies

The intervention landscape consists of a multitude of Kenyan and international NGOs and development agencies and their donors working in the agricultural sector in many counties and on all levels from farmers to policy-makers. NGOs are described in further detail below in their role as linking actors between research and practice.

Donors

Kenya is a major partner for most donor countries. Their function in the ALV innovation ecology is to provide funds and international expertise to the policy

arena, the research system and linking actors. The following strengths can be discerned regarding ALV innovation processes. Donors are influential, and endowed with budgets that can compete with governmental agricultural allocations. Furthermore, they are mostly up-to-date with the latest research results and technologies. Many international donors in Kenya support food security programs and commercialisation of the agricultural sector, in line with the national government's priorities. Nevertheless, there are also hindrances to their activities. Different, at times competing, approaches, languages and emphases lie hidden behind their agendas. Funding depends on the donor countries' development priorities, the interests and strengths of the private sector contribution and sometimes even on the limited time span of the donors' legislative period (Exp5; GIZ appraisal mission¹⁸).

Donors have taken little notice of ALVs, as food security is still considered in the quantitative sense of how to feed the *undernourished*, at the expense of crops contributing towards improving the nutritional security of *malnourished* populations (Exp8). In addition, the prevailing mind-set on how to measure the success of an intervention is still to consider the size of the impact, meaning reaching as many farmers as possible, rather than a targeted and holistic intervention. Interview partners lamented that this mind-set overlooks the fact that sustainable capacity-building and knowledge exchange need time and human resources and that both can only be measured over a long period of time and in qualitative impact variables, if they are measurable at all (Exp5). Two interventions assessed in this study that aimed to think about sustainable solutions from the outset were, first, funding for the development of inclusive curricula and, second, programmes including an awareness of the need for multi-stakeholder exchange (using e.g. innovation platforms as described in Part II Chapter 4) (GIZ appraisal mission). These potentials, however, require a coherent, coordinated approach that has so far been lacking due to little personal continuity in the design and evaluation of interventions (Exp5).

3.5 Value chain actors

Value chain actors comprise all actors engaging in ALV input supply, production, marketing and consumption. This includes input suppliers, farmers, traders, middlemen, wholesalers, and actors in formalised and informal markets. Input supply actors are considered under the two categories of multinational private sector

18 GIZ appraisal mission, new Green Innovation Centre of the German Development Cooperation, Stakeholder Meeting, Nairobi, 22.09.2014.

companies and national/regional private enterprises selling seeds, fertiliser and agrochemicals. The function of value chain actors within the innovation ecology is to implement inventions on value chain level, to exchange knowledge about these innovations and to convey their needs and problems to other actors.

3.5.1 Subsistence and commercial farmers¹⁹

Farmers represent the core target group of this study. They are the actors in the ALV innovation ecology who ultimately experiment with and adapt inventions.

INNOVATION BOX 1: Some examples of local innovations by farmers encountered by the SLE-team were the application of an organic mixture of fertiliser developed by a farmer group in Vihiga, increasing productivity (technical innovation); planting the vegetables in sacks in the slum of Dandora to avoid pollution and economise on space; experimenting with quality seeds acquired from KALRO Kisii instead of buying seeds from the local Agrovet in Kihara; repairing potholes communally with a technique using local material in Malava in order to be able to access the markets (social innovation); transportation of the vegetables in baskets and banana leaves to keep them fresh; making use of scales to standardise prices and avoid exploitation by middlemen in Kakamega Central; or frying the ALVs for five minutes instead of cooking them for hours to preserve nutrients in Navakholo.

The majority of both subsistence and commercial farmers still fall within the category of small-scale farmers dominant in Kenya.²⁰ The main difference between subsistence and commercial farmers is not necessarily their overall farm size, but the portion of the farm that is actually dedicated to ALV farming. For subsistence farmers, this is usually a small kitchen garden for home consumption and for occasional surplus selling on local markets. In contrast, ALVs are grown on almost the whole farm in the case of commercially-oriented farmers, who sell

¹⁹ See also Annex 7.

²⁰ Internationally, small-scale farmers farm on sizes of less than 12 hectares and with a household income of less than 5000 \$. In Kiambu, and even more so in Kakamega, farms are much smaller and range from 0,3-1 hectares (Exp13; Exp19).

regularly on local and town markets. Important to note is that commercial farmers do not only become commercial because their farms are a lot bigger, but also because they have better access to infrastructure, relevant information and advisory services. As a general trend, the study discerns differences in the socioeconomic characteristics of the two groups (Table 1). The gender ratio among commercial farmers is almost equal, whereas subsistence farmers are predominantly female. Commercial farmers are not rich, “but they are able to pay their children’s school fees” (Exp26). They tend to be better educated, use modern communication technology more often and converse in English and Kiswahili in addition to vernacular languages.

The problems in ALV production and marketing differ among subsistence and commercially-oriented farmers. Subsistence farmers complain of problems that are mostly input- and production related, such as access to quality seeds or irrigation (FGI2; FGI3; FGI12). They are aware of the commercial potential of the crops in local and town markets. Barriers to reaching these markets, such as access to means of transportation, independence from middlemen and lack of information about market dynamics are so substantial that marketing seems to be the “next level” after improving production and increasing their supply potential. It is for these reasons that subsistence farmers are mostly limited to local markets (Exp26). For subsistence farmers, many interviewees stated that the more organised in groups ALV farmers are, the better is their access to information, consultation, farming inputs, means of transportation and opportunities to market their produce successfully (FGD1; FGD2).

Commercial farmers’ value chain problems are on another level. Access to irrigation, transportation and marketing opportunities are lesser challenges. This may partly result from the fact that commercial farmers tend to live closer to the town centres. This difference has a regional component, since the study identified more commercial farmers in the peri-urban region of Kiambu than in the rural areas of Kakamega. However, one interviewee stated that the majority of commercial farmers produce ALV in Bungoma, a county on the border of Kakamega, which was not the focus of this study (Exp25). Seed quality, pesticide control, value addition and post-harvest problems meeting the quality requirements for entering formalised markets are common challenges for commercially-oriented farmers (FGI1; FGI4; FGI8). Information from advisory services is frequently implemented and adopted by these farmers, and they know about opportunities to improve production (e.g. through soil analysis) and about marketing.

Table 1: Socioeconomic characteristics of ALV growing farmer groups

Characteristics \ Type	Subsistence	Commercial
Access to infrastructure	Dirt road, potholes, on foot	Tarmack road Means of transportation: bicycle, motorcycle, car
Means of communication	Phone, radio	Phone (charged and sufficient credit), radio, TV, ICT
Access to advisory services For example extension officer, NGOs, home economics officer, service providers	Infrequent, dependent on membership in groups, by one or two types of advisory services	Frequent, exchange of contact data with advisory officer of choice, visits of multiple advisory services, feedback
Gender / age	Women > men, elderly	Women = men, youth (25-40 y)
Language	Vernacular (Kiluhya, Kisii, Kikuyu), Kiswahili	Kiswahili, English
Organised marketing	In groups	In groups and individually
ALV production	For home consumption, occasional selling of surplus	For home consumption and regular selling of produce
Farm sizes	0,3-1 hectare farms ALV farming in "kitchen gardens"	0,3-3 hectare farms ALV farming taking up a considerable portion of the farm
Land tenure system	Farm belongs to male household Staple crops are the mainstay of produce	Farm belongs to male household, but he supports or participates in ALV farming
ALV marketing	On local market	Organised marketing on local markets and markets in towns, formalized and informal markets
Value chain problems		
Input	<ul style="list-style-type: none"> ▪ Quality seed ▪ Information 	<ul style="list-style-type: none"> ▪ Quality seed ▪ Suitable fertiliser
Production rationale	<ul style="list-style-type: none"> ▪ Produce enough for family Seasonality (means of irrigation) ▪ Pest control 	<ul style="list-style-type: none"> ▪ Increase productivity and quantity ▪ Soil analysis ▪ Pest control
Marketing	<ul style="list-style-type: none"> ▪ Transportation ▪ Cooperation ▪ Exploitation by middlemen 	<ul style="list-style-type: none"> ▪ Storage of surplus ▪ Value-addition ▪ Post-harvest problems (drying) Quality standards

It is striking that commercial farmers, although they make use of the benefits of common interest groups, often grow and market by themselves, albeit employing labour (FGI9). Most of the commercial farmers in this study market close to their farms, with transportation times not exceeding one hour (Exp26).

3.5.2 Input suppliers

The category of input suppliers and distributors subsumes the most important private sector actors in the ALV sub-sector, namely Kenyan companies that produce and market inputs, multinational agribusinesses (such as Syngenta or Monsanto), and local distributors / Agrovets that sell the products of both national and multinational companies directly to farmers. All types of suppliers are represented nationwide. Their functions in the ALV innovation system are the provision of essential inputs such as seeds, fertilisers or agrochemicals as well as private sector services such as soil analyses.

Multinational private sector companies

Multinationals are endowed with large financial and physical resources and are able to advertise their products on major media channels. They can also exert considerable influence on the national and county governments (Exp13; Exp16). In remote areas, they are often the only available alternative for products like seeds, pesticides or fertilisers. Their self-assessment highlights their pragmatic, results-oriented approach to farmers: "We are face to face with the farmer, for a price" (GIZ appraisal mission). Farmers' perceptions of multinationals are ambivalent, ranging from trust to criticism of their profit orientation (Exp13). Critical views point out that multinationals offer their products free of charge at the beginning, which breeds a mind-set of dependency on the part of farmers, complicating the work of the extension service (FGD1). Multinationals are potential partners not only for the extension service but also for the research system, since they have strong (physical and financial) capacities in both areas, though their levels of training and expertise are far below those of the extension officers (Exp6; Exp16; FGD1). In their approach to supporting communities and training farmers, multinationals more often advertise short-term solutions such as spraying rather than long-term practices such as mulching (Exp21; Exp32). One interviewee and former multinational staff member mentioned that their outreach capacities for farmers exceeded those of the Ministry of Agriculture in scale (Exp6). ALVs have not yet become a priority for multinationals, the major reason being that the sector does not yet promise high profits.

National private sector companies

Kenyan companies were mentioned as important input suppliers for the majority of interviewed farmers. Seed companies were mentioned first and foremost. Other national companies providing, for example, fertilisers or pesticides were not mentioned as often by farmers, since many of the (subsistence) farmers use organic and home-made inputs for ALV production.

National seed companies may theoretically fill a huge gap in ALV production, since the majority of producers lack high quality seeds. In Kenya, there is only one governmental parastatal seed company that has become involved in the supply of ALV seeds (see Part III). The commercial importance of export and food crops as well as vegetables like tomatoes and cabbages still exceeds the demand for ALVs seeds (Exp4; Exp7; Exp21).

Agrovets

Agrovets distribute the products of input suppliers in almost every village in Kenya and vary in the ranges of products they offer, in their focus on ALVs and in the information offered by the owners. Both male and female farmers are regular customers (FGI5; FGI8). Many of them are run by veterinarians, who often visit their customers on farm to check on the livestock (Exp35). Since livestock is traditionally the domain of the male head of household, there is a gender bias in their targeting, although they are often versed in a variety of agricultural practices (Exp36). However, farmers often complain about their profit orientation. According to farmers, Agrovets are tempted to sell expensive, but not necessarily high quality or appropriate, products by misinforming their customers (FGI8). Other experts state that many Agrovets do not receive regular training to provide up-to-date information. Collaboration and training for them might be a future opportunity to complement information transfer, as is being pioneered by the Ministry of Agriculture (Exp23). Some Agrovets are run by former extension officers. Their customers benefit from their extensive farming expertise (Exp26; Exp35). However, they have so far engaged in little cooperation with the NARS, academic institutions and extension officers.

Private input suppliers, ranging from multinational and national companies selling agricultural products to the local Agrovets distributing them, are important actors in the ALV innovation system, since they have considerable resources and influence. In theory, they are able to provide farmers with useful inputs to support innovations. Up to now, few companies have been actively involved in selling products related to ALVs. Their interests are not always pro-poor. The profit orientation of the private sector results in targeting solvent clients, potentially leav-

ing out subsistence farmers (Exp12). Therefore, private sector research and extension programmes have to be evaluated carefully to ensure that their involvement in ALV innovation processes does not solely benefit those with sufficient resources (Exp5; Exp13; Exp18).

3.5.3 Traders and middlemen

Traders and middlemen comprise farmers who sell their own produce, and middlemen who buy from the farmers at the farm gate and sell to market vendors or wholesalers. Their function in the ALV innovation system is to link farmers with markets. Their means and type of transportation, or lack of it, and their opportunities for cooperation with other supporting, funding and marketing actors largely determine whether ALVs are sold in markets or not.

INNOVATION BOX 2: Farm Concern International (FCI) is a charitable development trust that facilitates marketing of ALVs. The main idea is to organise subsistence farmers in so-called “commercial villages” and link them to wholesalers and markets, thereby cutting out middlemen and significantly increasing returns for farmers. Pooling yields from many farmers, free transportation of fresh produce and knowledge of how to fulfil supermarket requirements are key to improving poorer farmers’ marketing strategies, as many interviewees stated. For farmers who supply the Kenyan supermarket chain UCHUMI, FCI offers to pay them immediately on presentation of the transaction receipt, instead of having to wait for the payment for two weeks (Larsen et al., 2009, p. 107). Arrangements like this have inspired and been taken up by the MOA, which has started to train extension officers accordingly to help with the linking and organisation process (Exp18; Exp19; Exp23).

Many interviewees identified middlemen as a large obstacle to improving the value chain (Exp18; Exp33; FGI3). They are mostly locals who do not farm themselves, but try to make a living through buying at the farm gates at low prices and selling to market vendors at higher prices. They constitute the majority of direct purchasing agents for farmers, especially in remote areas. Although they work largely unregulated and have a reputation for exploiting both farmers and whole-

salers, it remains to be determined whether their services in mediating transportation are key to a functioning value-chain, or whether they may easily be replaced by other actors (Exp32). Since this study did not focus on them, getting their views might prove valuable for future analyses.

3.5.4 Marketing options

“There are ready markets for ALVs”, was a ubiquitous expression, meaning that market vendors were able to sell the vegetables at high prices everywhere (Exp16). These markets may be divided into informal and formal markets, formalised supermarkets and bulk purchasers such as restaurants, hotels, schools, hospitals and prisons (see Part II: 2.2.4 Marketing). Whereas ALVs have always been present in local markets, supermarkets and bulk purchasers have only recently increased their demand for ALVs over the course of the last five to ten years (FGI1). This can be seen as an innovation potential in the logic of the ALV innovation perspective, meaning that the demand, purchasing power and preferences of the customers in these markets creates opportunities (for farmers and other actors) to experiment with various innovations.

Informal markets

Informal markets are local markets supplied by subsistence and commercial farmers alike and exist in every Kenyan town and village. They are created at the road side or in central town places wherever there are enough customers to allow for feasible profit margins. They include occasional surplus selling of ALVs on a makeshift cloth by the roadside (especially for subsistence farmers), and selling of larger volumes from the boot of a farmer’s car driven to the town square (especially for commercial farmers). The markets are not officially registered or permanent arrangements and get no support from the county governments. Nevertheless, many interviewees stated that the sale of ALVs on informal markets exceeds the volumes sold on formalised markets or in supermarkets two- or threefold (Exp18). Interviews with vendors and farmers hint at a two-level selling strategy on the part of subsistence farmers. Neighbours and other farmers buy on farm at reduced prices while consumers on local markets pay higher prices. The latter have increasingly become more urbanised and affluent (FGI8; FGI9; Market vendors²¹). Subsistence farmers mostly benefit from selling ALVs on their homesteads or on informal markets.

21 Market survey and interviews with vendors at local market in Kakamega, 1.09.2014.

Formalised markets

Formalised markets may look very similar to informal markets. The difference is that they are legally established markets by the municipal council in each city. Vendors need to pay regular market fees to be eligible to erect a wooden stall. These market barriers make formalised markets less accessible for poorer farmers. Of these barriers, the location of the markets within a city and the lack of services and market infrastructure (such as cooling and storage facilities) are key points mentioned by vendors (Market vendors, Kakamega). High transportation costs to formalised markets make it very difficult for subsistence producers to enter these markets. Unless subsidies, organisation in vendor groups and/or favourable agreements with other market vendors are facilitated by the municipalities, few opportunities exist for subsistence farmers to overcome this barrier (Exp18; FGD2).

Supermarkets

Supermarkets cater to the increasing demand for ALVs from the Kenyan middleclass (Exp23). Although their scope is nationwide, their willingness to cooperate with subsistence farmers differs, since few farmers are able to meet their quality requirements for fresh products and to guarantee consistent volumes. Such marketing agreements with (organised) subsistence farmers exist for supermarkets like UCHUMI, which are subsidised by the government to stimulate inclusive growth of agriculture (Exp19). However, most of the supermarkets' suppliers are commercial farmers who have enough resources to produce on time in sufficient quantity and quality and who are able to deal with bureaucratic payment procedures.

Bulk purchasers

Bulk purchasers pose similar problems to (subsistence) farmers by requiring high volumes and quality. They perform similar functions as formalised markets / supermarkets in the ALV innovation ecology, largely offering marketing incentives for commercial farmers. Differences in comparison with formalised markets are consumption-related problems. Large canteens lament ALVs' short shelf life and the complicated and time-consuming preparation of some ALVs. There is a lack of knowledge about cooking practices that preserve nutrients. Further campaigns regarding consumption habits, training for cooks and improving post-harvest practices to preserve nutrients were identified by several interviewees (Exp3; FGD2).

3.6 Linking actors

The term *linking actors* describes those actors that connect farmers and value chain actors with one another, with research institutions and with other actors, providing innovative solutions and knowledge. Their function within the ALV innovation ecology is to transfer knowledge and other resources needed for innovation among those actors, with the purpose of improving food security and sustainable livelihoods. As described in the following chapter on interactions, these linkages comprise a multitude of connections that are covered by an equally diverse number of actors. The three most important linking actors identified and analysed below are the governmental extension service, NGOs and the media.

3.6.1 Governmental extension service

The Kenyan national extension service has at its core the mission of training farmers in good agricultural practices and supplying them with information about agricultural innovations. In every Kenyan county, there are extension officers for several sub-counties, advising farmer groups structured in wards. The purpose is to increase farmers' productivity levels and opportunities for commercialisation and ultimately to strengthen their livelihoods (GOK, 2012, p.4). This applies to commercial as well as subsistence farmers. As a governmental actor, the extension service has a potentially high legitimacy. Nevertheless, the intended geographical coverage and continuity fall short of their objective of reaching every farmer (FGD1). Since the major staff cutback in the 1980s, the average ratio of extension workers to farmers has not exceeded 1:3000 (cf. Part II Chapters 1 and Part II Chapter 4). Due to a lack of means of transport, farmer groups closer to town centres are visited more often. In regard to ALVs, many farmers regard dedicated extension officers as a major source of knowledge about innovative farming and consumption practices. In comparison, marketing issues are covered less. This makes the extension service an important actor well placed to bring innovative solutions about ALVs to farmers, but less so to other actors of the value chain.

INNOVATION BOX 3: (FAILED INNOVATION) The Rural Outreach Programme (ROP) has been identified for several good practices, including promotion of local seed banks and linking poor farmers from remote areas in Western Kenya to the central markets in Nairobi. This was done through collaboration with a local bus company that picked up the farmers' produce at several collection points in the evening and brought it to the open air markets of Nairobi by the next morning. The inability of farmers and the ROP to guarantee sufficient supplies for the competitive city markets as well as the destruction of the ROP seed banks and offices during the post-election violence in 2007/8 led to the breakdown of this innovative transportation system. Today, the ROP groups sell their yields in local markets only, an activity from which they nonetheless continue to benefit (Exp13).

3.6.2 Non-governmental organisations (NGOs)

As described above (Part II: 3.1.3 Civil society), there are some NGOs that advocate on a range of agricultural issues, and others that work directly with target groups, especially farmers. Their main activities are training and advising farmers and providing inputs or information. Besides the extension service, they are the most important linking actor, linking research institutions to farmers and other value chain actors. This transfer of knowledge and resources, as described in more detail in Part II Chapter 4 below, is also the NGOs' main function within the innovation ecology. For this purpose, most NGOs in Kenya collaborate with a number of actors, including with extension officers in advising subsistence farmers on farming practices, with the private sector in linking farmers to markets, and with research institutions in disseminating selected research results and new agricultural practices and in giving feedback to policy-makers with regard to the adaptation and adoption of these practices (Exp7; Exp18; Exp34).

Regarding ALV innovation processes, NGOs have the following potentials. ALVs are a priority for many NGOs, and their vast experience in activities targeting almost all aspects of the value chain can be built upon (Exp19). The scope of their work differs, but their social networks are their biggest asset, for example faith-based organisations building on networks across all counties. Their outreach capacities and approach to knowledge exchange with subsistence farmers was

evaluated as exemplary by several interviewed partners. Farmers at times described NGOs as more available and up-to date for the purpose of knowledge dissemination than extension officers.

NGOs collaborate with the extension services for community entry and often supply them with teaching materials as an intermediary between research and practice (Exp13; FGD1). However, coordination remains a challenge, leading to a situation in which NGOs sometimes compete with the extension service. NGOs' influence on county governments is strong; they are important partners for collaboration regarding the provision of services for farmers (FGD2). Nevertheless, interviewed experts lamented the lack of national quality control of their work. Furthermore, NGOs depend on donors for funding, which often results in short-term interventions. This is an obstacle to building long-term trust with farmers into a programme's effectiveness and reliability. NGOs continually need to emphasise their comparative advantages over other organisations in order to be eligible for funding. This has been implied to entail a lack of critical self-assessment.

3.6.3 Media

The media comprise a range of important actors and channels disseminating agricultural knowledge and can be divided into television and radio programmes, Information and Communication Technology services (ICT) and newspapers. Since the study considered the media mainly with regard to their function as channels of information transfer rather than actors within the innovation ecology (though of course they are also actors), their characteristics will be described in full detail in Part II Chapter 4.

3.7 Actors' importance and influence

To compare and analyse the importance and influence of different actors in the innovation ecology, the study makes use of an importance-influence matrix (Figure 5) as described in the methodology chapter.

In terms of their pro-poor orientation as well as their focus on ALVs, the public extension service and local NGOs are key actors for the promotion and support of ALV innovations. They are closest to, and most trusted among, the farming population and can help ensure that farmers' voices be heard. Only farmers' participation and empowerment will make research, dissemination and development interventions more targeted, sustainable and pro-poor oriented.

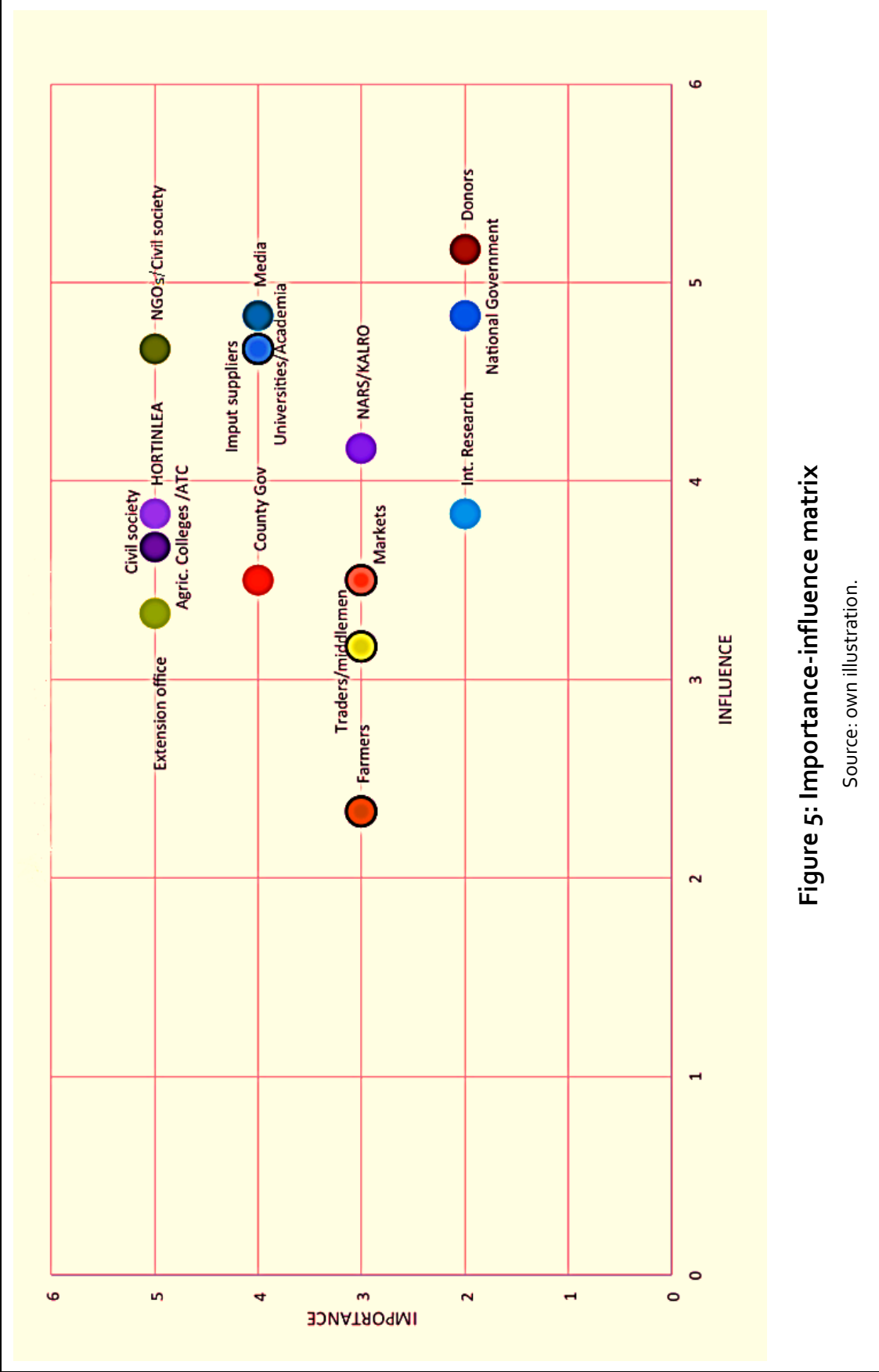


Figure 5: Importance-influence matrix

Source: own illustration.

As the crucial linking actors between research and implementation, the public extension service and local NGOs need to be strengthened the most in terms of their financial resources and human capacities in order to close the information-implementation gap between research, policy and farmers. In particular, the mostly defunct public extension service needs a major increase in its financial and human resources. It should be funded sustainably by the national government rather than depending on less reliable and insufficient donor programmes. Equally close and active in outreach to farmers are the Bukura agricultural college and the agricultural training centres that exist in almost every Kenyan county. In addition, they train future extension officers. Strengthening their resources and integrating ALVs into their curricula is a sustainable way of supporting both the extension service and farmers and of bringing research results into practice.

Other important ALV-oriented actors that are influential in terms of their power, capacities, resources and networking potentials are the county governments, KALRO, and the universities. They all already fulfil important functions within the innovation ecology but also face some challenges. The universities are the major actor in ALV research and promotion, not only generating innovations on campus, but also investigating how these can be better adopted by farmers. Their initiatives may be regarded as important pioneering work, but this has to be supported and coordinated by the national research system and the policy level. In this respect, the newly established KALRO, replacing KARI, is seen as becoming the most important national player coordinating and connecting agricultural actors from research, the private sector and policy to the farmers. Nevertheless, it has yet to prove that it can fulfil this role. The county governments are potentially very interested in supporting ALV innovations and pro-poor programmes at the local level. In their function to implement programmes adapted to their counties' potentials, they are a suitable partner in the implementation of ALV policies at the county level. The devolution process from national to county government has so far been lagging behind its promise, and substantial funding has not arrived at the county level. County governments still face great challenges regarding their financial and human resources.

Other actors seem less interested in ALVs so far, but are very influential in terms of the power and resources they have and the influence they can exert. These include national governments, donors, some of the media (especially TV), the private sector and the international research institutes present in Kenya. On many occasions, these actors face the common challenge of having little interaction with farmers, although they design policies, conduct research, sell inputs, or spread news for them. Many farmers interviewed for this study were not aware of

the international research centres. These actors are also seen as potential threats to pro-poor policies and the support of neglected crops. They need to be made more aware in order to win them over for the case of ALVs and to make use of their capacities. For instance, while many interviewees view the private sector very critically, some private sector actors could still be important partners for various tasks within the innovation process, from input supply to disseminating quality information.

Last but not least, farmers are perhaps the most important actor group in the innovation process. They are the active innovators, key for the success of each step of the innovation cycle, from ensuring relevant and demand-driven research to the ultimate utilisation of research results and the adoption of innovations. They are not a homogeneous group, as is often assumed. This study discerned an approximate differentiation into two farmer groups with regard to their level of commercialisation. Further research is necessary to investigate their specific needs and strengths. Subsistence farmers face the greatest challenges in terms of their ability to participate in the ALV innovation ecology, and this pertains especially to women and young farmers. This poses a major threat to the entire innovation ecology. Farmers with better access to information, infrastructure and advisory services adopt and advance innovations on an entirely different level of commercialisation. Differentiated subsidisation and support for the two groups is necessary if innovations are to be implemented for their specific benefits. In this process, strengthening farmers' participation, ownership and empowerment sustainably will be key to creating a truly inclusive, successful and impactful pro-poor innovation ecology.

4 Interactions

The quality and direction of interactions determine the success or failure of the interactive innovation process and therefore an innovation's impact on its target or user group. In the innovation ecology three aspects or forms of interactions need to be considered in order to be able to assess a specific innovation process²². As an example, to use a new method of ploughing, a farmer (1) not only needs to have the financial means to buy the plough or otherwise obtain it from another actor, (2) he/she will also need to be taught or to receive information on how to use the new tool for the new practice. (3) This resource transfer will involve a wide range of actors that are linked and related in one way or another depending on their different interests, mandates and resources. The first two aspects therefore consider the transfer of resources such as information, inputs or funds needed for innovation. The third one is concerned with how the actors' linkages structure these transfers of resources and other forms of collaborations. To clarify, these three aspects can be defined as follows:

- The flow/transfer of information and knowledge (as the crucial resource for innovation) within the network of actors in the system. This includes a description of what information is passed on, by, to and between whom, how it is done and for what purpose. It also looks at the interactive learning processes between actors.
- Access to resources or the transfer of resources, i.e. how resources are linked to and made available to actors by other actors in order to be able to participate in the development, diffusion and adoption of an innovation.
- The actors' formal or informal linkages and power relations, including the way they influence each other, their collaborative partnerships and their coordinative functions (or lack thereof). These linkages guide and structure the aforementioned transfer of resources, possibly supporting or hindering flows. They are determined by the actors' interests, resources and power as well as the purpose of the interaction.

²² These aspects are descriptive and analytical categories used to look at interactions from different points of view. They are therefore not necessarily exclusive, but rather interdependent and overlapping, highlighting different angles.

The three aspects will be discussed in reference to the overall innovation ecology of ALVs and interpreted against the backdrop of their positive or negative influence on the overall innovation process. In addition, they will be assessed regarding their pro-poor potential and impact. Determinants, opportunities and challenges for good interactions will be highlighted. Depending on the specific problem to be tackled, there will of course always be more or less relevant interactions to be targeted and/or strengthened in order to implement a successful problem-oriented innovation system (see Part III).

4.1 Information transfer between actors

This subchapter describes information flows and transfers between actors, whether organisations or individuals. Information and knowledge, though non-material, are key resources in most ALV innovation processes. In theory, pro-poor solutions are know-how- and labour-intensive as well as low cost, needing few inputs and having high affordability, availability and impact for poorer farmers. However, the uptake and utilisation of such solutions heavily depend on sustainable and widely available access to relevant and affordable information and training.

Within the innovation ecology of ALVs, information is transferred by a variety of actors, in a variety of forms and through various channels, which serve different purposes such as extension, research or even advertisements. These processes are key to the functioning of the entire system of knowledge production, management and dissemination. Important actors are first of all the farmers themselves, being holders and “teachers” of local and traditional knowledge. In addition, research actors (including some private research), whose primary mandate is to generate new knowledge, as well as various linking actors such as NGOs, extensions services and the media, are key to the transfer of information. This study distinguishes two main channels that can be used to transfer knowledge, namely directly, i.e. using face-to-face communication between actors, or via the media. In the following, processes of information transfer are described according to the channel used, purpose served and actors involved. These means and activities are described and analysed, first putting a special focus on farmers as the main target group of most information dissemination efforts and the end-users and implementers of most innovative solutions along the value chain of ALVs.

4.1.1 Direct / Face-to-face information transfer

Face-to-face information transfer and dissemination targeting farmers

There are numerous ways that agricultural knowledge is passed on directly to farmers. Taking farmers as the study's focal point, direct farmer-to-farmer exchange of agricultural knowledge and other information (such as market information) for the diffusion and adoption of innovations is extremely important. Much knowledge about farming practices is passed on within the family from one generation to the next, as most of the farmers confirmed. They regularly exchange ideas with their neighbours or on the local markets, and use other organised or ad-hoc forums to get in touch with peers from different communities. These include *barazas* (community assemblies), farmers organising and meeting in Community Based Organisations (CBOs), Common Interest Groups (CIGs) or Farmer Organisations (FOs), facilitated farmer-to-farmer knowledge exchanges (through NGOs or the extension service), farmer field days / farmers days facilitated by extension services, NGOs or agricultural training centres, and agricultural fairs and shows where farmers from even quite remote areas can meet and exchange knowledge.

A farmer from Kwishero farmer group in Kakamega aptly summarised the multifaceted processes of farmer-to-farmer exchange and self-help across communities and different actors as follows:

Another way is when we hear there are field days, agricultural field days, some farmers go to attend and there we interact with different stakeholders and then we get their contacts and then we make a follow up, we call them, we tell them that we would like you to come to our group so that we share our knowledge and then from there we get linked to different stakeholders and then we find that if we have problems in our farms we can easily get someone with that particular skill, if that person does not have that skill, he will advise us on who we can call and then we will get in touch (FGI8).

While farmer-to-farmer exchange is valuable, the majority of farmers and other actors still view public extension or similar advisory services at the grass-roots level as the primary source for new or locally-adapted information (Bachmann et al., 2014). The public extension service's mandated activities and approaches include organising farmer exchanges such as participatory farmer field schools, conducting e-extension via telephone, demonstrations / field days and providing some inputs. Most importantly they visit and advise farmers (individually or in organised groups) on their own fields depending on the problems identified (FGD1).

In reality, however, public extension services' reach and coverage today are rather limited, their information often outdated. This is due to the long-standing

human and financial resource constraints described above (see Part II Chapter 3). Various interviewees stated extremely low average extension-officer-to-farmer ratios of about 1:3000, resulting in extension officers visiting communities too infrequently to be able to follow up their recommendations sustainably or even not being able to visit at all. Some communities had never seen an extension officer. The low officer-to-farmer ratio also makes extension services give up individual farmer training altogether in favour of only serving organised CIGs (FGD1).

The resulting information gap is in many cases, though certainly not always, filled by NGOs, public advisors working for other ministries (such as the governmental departments of nutrition and home economics of the MOH and MOA at the county level) or donor programmes that fund parallel structures such as the parastatal KAPAP's provision of public or private agricultural extension services to CIGs. In addition, private or public companies' own advisory services and field days, Agrovets advising farmers individually, or even scientists, media workers and other devoted individuals such as researchers try to promote their insights directly to the farmers (Exp4; Exp7; Exp10; Exp13; Exp23).

Accordingly, the knowledge transferred is heavily dependent on who is disseminating to the farmers, their resources and rationalities. For instance, multinational companies such as Syngenta, but also the parastatal Simlaw Seeds Company that specialises in ALV seeds, have their own extension staff in the field, promoting their products in one way or another. Meanwhile some NGOs' activities are heavily influenced by donor agendas or individual/organisational preference for certain agricultural practices (Exp4; Exp33; FGI2) (see also Part II Chapter 3). Additionally, having access to direct advisory services at all is dependent on a community's location, levels of organisation, education and networking, and often on pure luck. According to national coordinator Francis Muthami, the KAPAP has been able to reach 113 000 farmers directly and about 400 000 indirectly, working in 20 of the 47 counties (Exp10). This is a great scope, but like most donor interventions it only reaches a part of Kenya's more than 20 million farmers and it cannot replace public extension altogether.

Statements regarding the significance of ALV-related information compared to other agricultural information provided varied a lot between actors. While some advisory services (especially a few NGOs, including ROP and FCI, and the public nutrition specialists promoting mother-to-mother exchanges about ALVs) specifically promote ALVs as part of their curriculum, others do not do so yet (Exp18; Exp33; FGD2; FGI9).

Extension services' structural constraints and the limited scope of their advisory services also make other innovative and complementary methods of direct farmer training and information dissemination even more necessary and indispensable to achieving a larger coverage (see also Part II: 4.1.2 Information transfer via media).

Agricultural Training Centres (ATCs) provide demonstrations on their own plots on topics ranging from crop selection, land preparation, planting, pest control or value addition (Exp30). Farmers or farmer groups are selected for participation by their respective extension officers based on the relevance of the topic to them. They can, however, also individually visit ATCs for advice, though the scope of this service remains very limited due to high transportation costs and time input for farmers. ATCs also offer annual field days, which are attended by about 1500-2000 farmers per year and which are also attended by private sector companies to advertise their products.

Universities, ICIPE, Bioversity and KALRO also offer annual or half-yearly field days open to farmers, where innovations are presented (Exp5). Given the sheer numbers of farmers in need of relevant and up-to-date information, these activities seem only to serve a small and usually well-connected, better-off part of the farming population. Some agricultural universities' extension departments also offer Training of Trainers (ToT) on a regular basis through their county sub-offices, which are employed to disseminate information and reach a higher coverage (Exp6).

Face-to-face Information transfer targeting linking and other actors

Even though farmers are the main target group of agricultural information transfer, for the right information to reach farmers and other actors in the innovation ecology such as researchers, it is of equal importance to have competent staff in linking institutions such as extension services and NGOs, as well as in government agencies, universities and so forth. This requires continuous vocational training and adaptation of curricula and training material to the newest and best agricultural practices and research results.

In Kenya, a range of actors train staff for various purposes: Universities teach students to become future specialists and to some extent extension workers, the nationally funded mid-level Bukura College trains students to become farming entrepreneurs, agronomists and extension workers, and schools give lessons on farming, health and nutrition. The focus here is on the linking actors that do direct training with the farmers. Their human resources were identified as the major bottleneck in reaching the farmer with up-to-date knowledge. Government funded refresher training sessions, having become very rare since the liberalisation of extension services, have not been offered at all since devolution. Without adequate

funding, counties are currently unable to offer them. Extension officers have to rely on their often outdated college knowledge or educate themselves individually, collecting bits and pieces of knowledge from researchers, the media or other advisory services such as NGO staff (FGD1).

External donors and private actors have stepped in to some extent, offering training to extension officers in a few selected counties (Exp10; Exp27; FGD1). Donors, however, often only fund training for their chosen partner organisations (often NGOs), or even start their own parallel extension service. For example, the World Bank has, in collaboration with the MOA, been funding a parastatal extension service working in parallel with the public extension service, through the KAPAP programme. This service is well-equipped and up-to-date. However, as seen above, this does not sustainably solve the challenges posed by the structural constraints of the government's own extension service.

4.1.2 Information transfer via media

There are various media used as channels for spreading agricultural knowledge, namely television and radio programmes, information and communication technologies (ICTs) and print media such as newspapers, magazines and other outreach material (handbooks, leaflets etc.). This chapter focuses on how they are being used to disseminate information, by whom and for what purpose. Consequently, their importance as a way for farmers to access information is assessed. It is also crucial to differentiate between media channels regarding their target groups, affordability and accessibility, their reach and appropriateness.

Radio

The radio was mentioned repeatedly by many farmers and other interviewees as being the most important channel for receiving agricultural information besides the government and non-government extension services. Almost every farmer, whether male or female, whether formally educated or illiterate, has access to a radio, though some are even too poor to buy one themselves (FGI12). There are agricultural programmes not only on national radio stations such as the Kenya Broadcasting Cooperation (KBC) but also on many vernacular stations that broadcast in the local languages and are more adapted to local needs.

National programmes have the advantage of reaching a greater part of the population, while vernacular radio programmes can be more regionally targeted and demand-driven. Translation of content and its adaptation to local conditions, however, remain some of the greatest challenges in terms of the funding, time and effort needed. Often only the big multinational agrochemical companies are

able to pay for advertisements or even regular airtime on the radio, thereby heavily influencing the content being provided (Exp14).

The one-way nature of the radio as an information channel was also mentioned as a challenge, leaving little room for farmer feedback. In comparison to print or online material, content may also be lost or forgotten much faster, and follow-up is only conducted sporadically. Nevertheless, research organisations and NGOs such as KALRO, KAPAP, JKUAT, Biovision Kenya and FCI, among others, regularly provide content to both national and vernacular programmes and their staff visit live radio shows for question and answer (Q&A) sessions. Extension staff praised the radio as a good starting point for new ideas and information, though they insisted on the importance of direct extension services for further training and advice (Exp13, FGD1).

Television

The Television (TV) is another important source for agricultural information dissemination. TVs are affordable only for some better-off farmers, though communal networks often allow shared viewing. The big national TV programmes such as *Shamba Shape Up* or *Mkulima* are well known even among poor farmers. The comparative advantage of the TV medium is that the agricultural practices demonstrated are more easily understandable and language barriers are easily overcome (Exp12).

ALVs have not yet gained much ground on the TV on a regular basis. One reason for this is the cost of airtime. Nevertheless, their presence on TV is being promoted by some NGO initiatives or individuals from research institutions. There are memoranda of understanding (MoUs) between research and media actors to provide content in return for airtime. For instance JKUAT has co-produced a documentary series on the ALV value chain that aired on the programme *Mkulima* on the KBC national TV channel (Exp3; Exp7). Even more so than on the radio, however, advertising and even airtime are sold expensively to private companies, often multinationals. As there is also neither regulatory nor monitoring framework regarding the quality and independence of the information disseminated, this results in content often being biased towards private interests. As on the radio, only some live TV shows leave space for farmer feedback or Q&A.²³

23 Besides TV shows, some actors such as KAPAP have also produced tutorials on video and distribute them to farmers. Data on their reach is too scarce to evaluate the impact of such videos. It is assumed, however, that in comparison to TV shows, videos reach a rather small number of farmers.

Information and communication technologies

Many actors, such as donors and governmental agencies, see information and communication technologies (ICTs) such as mobile phones, SMS-based services and the internet as the “next big thing” in information dissemination and exchange, facilitating quicker and more targeted exchange between research and farmers, as well as among farmers themselves. However, these technologies need to be scrutinised carefully in terms of their pro-poor potential. In particular, their affordability and usability for the many poorer, often illiterate users remains questionable.

The most common ICT used for information transfer is, by far, the mobile phone. Almost all farmers own a simple handset and use it regularly for knowledge exchange with other farmers, contacting NGO staff or extension officers or placing orders with local Agrovets. Farmers, NGOs and extension officers alike praise the phone’s affordability and ease of use for quickly advising farmers or redirecting them to others who may be able to assist with a specific issue (Exp18; Exp33; FGI12). Individual researchers also use the phone to stay in contact with farmer groups and hand out their numbers for farmers to get back to them with information or inquiries (Exp6; Exp7; Exp34).

There are also a number of automated services via phone, most of them SMS-based. The extension services and KALRO work together on rolling out so-called e-extension services, which are seen as having a great potential to fill existing gaps in extension coverage. These provide text-messages on specific issues on a daily basis or as requested via a menu. There are also plans to provide interactive lectures on farming issues that farmers can listen to on the phone (Exp11; Exp15). Some private services include the Kenya Agricultural Commodity Exchange’s (KACE) daily provision on market information via SMS or the private service *iCow* that sends out SMS advice on livestock and poultry issues.

Internet-based services and social media are also seen as an important new information source, especially for younger, computer-literate generations. There are a number of social media forums, where farmers can exchange problems and assist with solutions (e.g. *Mkulima Young* on facebook), as well as agricultural news pages like *hortinews.co.ke*, and online marketplaces such as *OLX* (the Kenyan eBay), where some farmers market their produce. Online platforms like the Africa-wide eRAILS platform or the *Kenya Agricultural Information Network (KAINET)* let farmers create their own websites and share their experiences. In comparison to the mobile phone and even some very simple SMS-based services, however, the internet has not yet gained a large user base among the poorer farming population. It remains to be seen whether in the future a rising popularity,

improved computer literacy, and a wider distribution of computers or smart phones will make internet based services and social media more important for the exchange of agricultural information (Exp15).

Print media

Various print media also play a significant role in the dissemination of knowledge and the promotion of ALVs, especially for research actors and some NGOs. There are weekly agricultural sections in newspapers (e.g. *Seeds of Gold* in the Standard), but many farmers cannot afford to buy them. More suitable seem to be free magazines such as *The Organic Farmer* published by ICIPE and the NGO Bio-vision Kenya, which tries to break down new techniques into understandable language. Available every month in English (in Tanzania also in Swahili), it has a reach of about 300 000 farmers and covers a wide range of topics regarding organic farming practices. Extension officers and NGOs in the field also use it to educate themselves and help distribute it to their CIGs (Exp13; Exp33). ALVs have so far only very sporadically been covered by *The Organic Farmer Magazine* (Exp13).

Many NGOs and other actors produce outreach materials, including flyers, posters, cookbooks and manuals on farming techniques, or print some advertisements in local newspapers (Exp10; Exp13; Exp18; Exp21; Exp33). Some of them use comics or pictograms to also reach illiterate farmers. Scientists of course also publish in scientific journals or even books. The target audience of these publications is usually strictly academic and access is often limited even for other research institutions or intermediary/linking actors (Exp30).

4.1.3 Research and knowledge management

Information transfer is not a one-way street. The innovation systems perspective emphasizes the essential element of continuous interactive learning (by doing) between all actors involved in innovation processes. Interaction is essential for successful and sustainable exchange. As described above, however, most activities involving information transfer still primarily aim at disseminating specialist knowledge in one direction: top-down from research to end-users via channels such as extension, the media or other intermediaries. In itself this does not pose a problem. However, only information relevant, accessible, adaptable and adoptable for target groups will actually be utilized. It therefore still remains to be discussed and analysed how the information disseminated is gathered, generated, quality-checked, harmonised, monitored and evaluated in the first place, and whether it is actually demand-oriented or simply supply-driven.

Subsequently, this subchapter assesses the following important evaluation criteria regarding research, extension and knowledge management: (1) Farmers' involvement in research and extension activities throughout the entire innovation process. This includes consideration of their needs and capabilities as well as a general acceptance that farmers need to become or be made into innovators in their own right, rather than just beneficiaries of research; (2) the existence and quality of feedback mechanisms for the knowledge disseminated, as well as all actors' continuous willingness to learn and adapt; and (3) the mechanisms for co-ordinating, updating and harmonising knowledge across actors and activities, according to the aforementioned needs assessments, priority-settings and feedback from users.

This subchapter will look at the existing predominant paradigms and methods of agricultural/horticultural research and extension in Kenya and, in a second step, at how existing and newly-created agricultural knowledge is generally monitored, evaluated and managed within the system.

Planning and implementing research, extension and development interventions

Interview partners across research institutions emphasized the importance of needs assessments, incorporating and building on collective local knowledge, as well as farmer participation and feedback throughout the entire research and dissemination process (Exp1; Exp3; Exp8; Exp11). Participatory on-farm research was praised by many experts as the way forward in order to achieve relevant results, adapted to farmers' needs. As an example, Patrick Maundu vividly described Bioversity's research process for ALVs:

It was two-way. We provide them [farmers] with seeds, they grow, they experiment, we also learned from them. So it was a two-way process. So it's providing them with seeds, providing them with information, what we had at that time. Of course as time goes on they gather more information than you. They learn more on how to grow. They are so innovative, you teach this and then after 1-2 months down the line they have changed it completely. [...] There are many examples of this process. If you go to Kiambu area you'll hear this: This is the way I was taught, but I changed it, and changed it and changed it, and this is what I have!

Farmer testing (e.g. of new varieties and practices) and feedback are seen as crucial and claimed to be conducted regularly by researchers from KALRO to international research centres and also by companies such as Simlaw Seeds producing ALV seed (Exp4; Exp8).

Research institutions also collaborate with NGOs in the field, who relay farmer feedback to them for further investigation (Exp13; Exp18; Exp27; Exp33). However, some actors expressed skepticism as to the level of demand-orientation and participation in the majority of research activities. This is due to time, personnel and funding constraints (Exp1; Exp5). A recent study on the demand orientation of the IARCs' research results also came to the conclusion that too much research is still driven by donor agendas rather than actual farmer demand and still conducted from within an 'ivory tower' (Bachmann et al., 2014). Generally, there is a great awareness of the further need to strengthen on-farm, needs-driven and participatory research.

When it comes to researchers' and other actors' extension, training and outreach activities the picture is similarly ambiguous. Feedback and needs assessments are seen on the one hand as crucial to improving the information disseminated. Feedback mechanisms vary in their degree of institutional formalisation. Farmer groups can request specific training from extension services based on their needs; they can also call some NGOs directly if they have an issue and get a specific answer (Exp27; Exp33). Many research and training institutions, such as KALRO, Bukura College, universities, intervention programmes such as KAPAP and NGOs, carry out, for instance, formal baseline surveys or stakeholder workshops to set the right focus and monitor, evaluate and plan their activities and interventions according to local needs (Exp6; Exp10; Exp11; Exp21; Exp30; Exp33). Less formal farmer feedback is also used to update outreach material, training content and curricula (Exp3). Media also try to encourage feedback on their programmes (via phone, SMS or email) or offer interactive Q&A formats with specialists (Exp7; Exp12; Exp13). Actors that offer extension services also offer farmers direct advice on specific problems they encounter. If they do not have a ready answer themselves, they pass the issue on to specific communities of practice or research institutions (Exp9; Exp18). Many actors also mentioned elaborate monitoring and evaluation processes conducted by themselves, their stakeholders or members (including farmers), or third parties to continuously monitor their activities, though for some actors, such as donor-funded NGOs or agricultural colleges, formal evaluations of their activities or curricula are often too costly (Exp18; Exp21; Exp30). NGOs such as Farm Concern International (FCI) continually review their own work in forums of stakeholders and beneficiaries including all levels, from district officers to community chiefs to *barazas* (Exp18).

As with research activities, the impact of feedback from farmers and others and consultation on outreach and other interventions must be scrutinized carefully. Often, a seemingly inclusive language and approach is not necessarily reflected in

the resulting intervention, especially when the agenda is heavily donor driven. In planning activities, the study therefore realizes the importance of leaving space to take on board the results of stakeholder inputs.²⁴

Information and knowledge management

In addition to looking at the channels used to transfer information, it is equally important to consider what information is passed on and how this knowledge is coordinated, kept up-to-date, harmonised and quality controlled. As described above, there are numerous ways farmers' and others' feedback and needs are incorporated into research and outreach activities.

The NASEP aims at harmonising and coordinating extension curricula and training extension officers accordingly, utilising knowledge from universities, KALRO and other relevant actors (FGD1). Content is supposed to be designed coherently at the Extension Service's MOA headquarters in collaboration with the relevant ministries, namely the MOH, MOE and the MOA department of home economics (FGD2). Nutrition officers stated that the ministries do indeed offer extensive teaching materials about nutrition and health. Others, however, insisted that the MOA does not prescribe nor even offer any harmonised, up-to-date content to public extension officers (Exp13; FGD1). In reality, extension officers only receive new knowledge piecemeal from various sources, including KALRO, farmers, seed companies and NGOs, but neither in a regular and coordinated fashion nor based on farmers' needs (Exp16; FGD1).

According to a recent study, this results in an apparent gap between what knowledge farmers need and what they get from public, private and non-governmental advisory services (e.g. too much information on farming practices and specific crops, too little on marketing) (Exp2). In contrast to the situation about 20 to 30 years ago, private sector advisory services (including Agrovets) and NGOs are not publically regulated or coordinated at all in their outreach activities. Farmers and public extension officers alike lamented advisory actors' sometimes vested interests as well as a lack of regulation, coordination and quality control of the sector (FGI8; FGI10). According to extension officers, private service provision requires more regulation, including mandatory training for advisors (FGD1).

24 For example, in the case of the new *Green Innovation Centre* of the German Development Cooperation, it was the experience of the study authors that while consultations were carried out broadly, opportunities for later participation were limited to a (pre-)selection of partners by the donor. These included neither farmer representatives nor civil society or the wider research community, even though these groups had participated in consultations with the official GIZ appraisal mission.

According to interview partners from the policy sphere, the government is aware of the need to coordinate providers of extension services and is in the process of designing national and county-level steering mechanisms (Exp10) (see also Part II: 4.3.2 Collaboration and coordination). Closely intertwined with the problem of coordinating the activities of the various linking actors across the sector is the question of managing existing and new knowledge in the horticultural sector (and ALVs in particular). “We have the innovations lying on the shelves, but they do not reach the farmers” was a common sentiment among researchers and linking actors (Exp11).

As explained in the actors chapter, Kenya has the advantage of strong agricultural research. Adding to this a rich history of large-scale international multidisciplinary research projects in the country, relevant research results and therefore innovative and even pro-poor solutions are in no short supply, as many experts confirmed (Exp7; Exp5; Exp11). Much of the knowledge, however, is unfortunately lost to one-off scientific publications. This is still regarded by many researchers as the most important output of research activities and it is only available to a select educated public. For instance, due to a lack of funding, not even institutions such as the Bukura Agricultural College have regular access to academic journals, and they therefore cannot teach their students using the newest research (Exp30).

Too little consideration is also given to post-project knowledge management and coherent coordination, communication and dissemination strategies within and between the researching organisations (Exp5). Interviewees from the intervention landscape and research community alike stated that donors should give these crucial long-term aspects of research and intervention projects more consideration and funding (Exp1; Exp5). Some of the research institutions do not have an internal knowledge management system, while existing databases such as the Kenya Resource Centre for Indigenous Knowledge (KENRIK) database on ALV germplasm are not (yet) known nor widely used by other actors (Exp3; Exp5; Exp34). However, research actors confirmed a theoretical change in thinking as well as steps being taken towards more coherent knowledge management systems. Two examples of upcoming larger-scale online platforms are the Kenya Agricultural Information Network (KAINET) and the Africa-wide online community eRAILS. KAINET is hosted by KALRO and collects and manages research results from various sources including universities and the MOA, KEFRI and international organisations like FAO and FARA (Exp11). The platform eRAILS was founded by FARA with World Bank and African Development Bank funding. It is an online community that lets users share agricultural research findings, farmer experiences, technologies and all other kinds of information from specific value chains across

Africa. In Kenya, it is also hosted by KALRO. Farmers are trained and encouraged to start their own eRAILS webpage and share experiences and knowledge. They can submit questions and get answers from a community of practical experience (Exp15). The two platforms will both fall under the umbrella of the still to be implemented KALRO College, where it is envisaged that research findings and projects will be centrally collected and coordinated²⁵. These are just a few examples of many existing knowledge management platforms and networks in Kenya. So far an effective and centrally accessible knowledge management system involving all major players and existing mechanisms has not been achieved.

4.1.4 Determinants of information transfer and management

As seen above, a great variety of information dissemination and research activities is conducted by a range of actors employing a number of different channels and approaches. The approach chosen will, however, have a great influence on the success of innovation processes, their possible pro-poor impact on the value chain and therefore ultimately on the target group.

This study has identified and analysed a number of interlinked issues, opportunities, good practices and challenges regarding information transfer, which determines successful pro-poor innovation and is discussed below.

Modes of information transfer and exchange

While the media are seen by many as an effective way and future opportunity to reach more people and even have them participate more (via ICTs), an overwhelming majority of farmers, especially the poor, see direct on-farm training of farmers by skilled and trusted advisors, whether public or non-governmental extension workers, as the most important way of transferring information. Direct trainings allow for more targeted and comprehensive information packages. They also allow for more direct feedback and continuous follow-up as well as Training of Trainers (ToT) and the facilitation of farmer-to-farmer exchanges. In particular, mutual exchange and trust building must be seen as key to ensuring adapted and pro-poor innovation processes that minimise risk for farmers while securing impact. Like any other channel, direct farmer training comes with a range of preconditions that make it especially difficult for them to function well in an environment like Kenya: Given widespread rural poverty, in order to be effective they need to be offered free of charge. They also need to be conducted frequently enough and to reach all farmers equally. Currently, none of these conditions is sufficiently met.

²⁵ See also Part II: 4.3.2 Collaboration and coordination, for more information on this planned institution.

Therefore, sustainable change for the better is not in sight. This means that complementary channels are still of great importance in bringing a message across. The radio is affordable, available and understandable to most farmers (when in the vernacular), and therefore plays a significant role for poorer farmers, who have neither the literacy nor the financial means to use other media channels. In summary, not every information channel is suitable for every farmer or other actor. Sustainability, affordability, and availability must be considered and improved across all channels in order to reach remote and poorer populations, and to enable pro-poor impacts. The right language must be spoken. Actors need to make an effort to translate their information into their target groups' languages and adapt it to their educational level, while ensuring it remains user-friendly and readily applicable.

Information quality control and management

As well as the question of how information is disseminated, it is important to consider where it comes from and how it is coordinated. After a long period of unsatisfactory results in agricultural research and extension, the subsequent shift towards more inclusive research approaches shows that the old top-down and supply-driven approaches to research and extension need reconsideration. The information transferred is too often not relevant to farmers' problems. Demand-driven research has to assess farmers' needs and incorporate them, their indigenous knowledge, solutions and feedback into the entire research process. The same goes for the extension services. Demands need to be assessed and addressed more. Therefore all actors should take farmers' existing and potential capabilities more seriously and become more willing to learn from each other. Only solutions relevant to and adoptable by poor farmers will become successful pro-poor innovations. In order to ensure that the right knowledge reaches the right people the shift in research and information transfer must be accompanied by well-coordinated and freely accessible knowledge management systems, and rigorous quality control of the knowledge and information transferred. In addition, a thorough regulation of the actors involved in dissemination activities is necessary. In practice, several factors, such as the involvement of so many actors, a weakened extension service and a weak regulatory framework for the private sector, combine to make training and outreach content fall short of the required standard.

4.2 Resource transfer between actors

For many farmers and other actors in the ALV subsector, access to quality information is the major bottleneck for their ability to innovate and to solve their value chain problems. However, information is just one of the resources needed. Socio-economic context factors and actor resources such as access to land, physical infrastructure such as markets, and access to finance have already been discussed in earlier chapters at the macro level and in terms of the actors' general capability to become innovators. Now, the study turns to examine more closely the resources (other than information) that are transferred directly between actors in order to support or enable a specific innovation process or system. These can include inputs such as seeds, fertiliser or machinery, or services and finance. Again, the affordability, sustainability and availability of the resources transferred must be scrutinised in order to evaluate the innovation's eventual pro-poor potential. A lack of access to resources or a limited capacity for transferring them can become obstacles to innovative solutions along the value chain, especially for poorer actors.

Some resources needed for innovation may be provided by one actor to another, either for free or for a fee, while others need to be purchased on the market. Often they may not be available at all. Resource transfers can occur at various levels of the innovation ecology, for example, the government or a development project may provide farmers with an irrigation system, or a donor may fund an NGO to provide training or inputs such as seeds. The following two subchapters focus on the provision of seeds and finance to farmers as specific examples of interactive resource transfer. These have been identified as the most important resources for ALV innovations targeting some of the pressing value chain problems described above.

Provision of seeds²⁶

For many farmers, inputs such as seeds, fertiliser and pesticides are a major bottleneck to improving their productivity and being able to innovate. Seeds were mentioned by many interviewees as the most important input, but also a main bottleneck, for the production of ALVs. However, Simlaw Seeds, being the only national company producing and marketing ALV seeds, is not able to cover the whole country. In addition, for farmers living in extreme poverty seeds may also not be affordable.

26 For an example on how it may be possible to solve the seed problem using an innovation systems perspective see Part III.

In order to enable farmers to grow ALVs, but also for other purposes such as seed research, a variety of actors provide farmers with seeds for free, especially NGOs (including FCI, ROP, SOFDI, ADS and KENRIK). One interviewee even mentioned that the extension service sends farmers to their NGO in order to get ALV seeds (Exp33). Others such as KALRO or the Bukura ATC who produce seeds themselves sell them at subsidised prices. Often these are still too expensive for farmers. There are also collaborations between NGOs and research institutions such as KALRO, AVRDC and the farmers themselves, where seeds are handed out for free and farmers in return have to test them and give the researchers their feedback, creating a win-win situation, but also covering only part of the farming population (Exp8; Exp30; Exp33; Exp34; FGI8). Since devolution, a few counties have started buying and distributing ALV seeds to farmers, something the national government had never done (Exp4).

Provision of financial means

For many innovations a financial investment is needed for the purchase of machinery, inputs or services. As discussed above, financial resources and access to finance (loans) are often very limited. There are, however, a few good examples of actors transferring financial resources in order to support investment in innovation processes.

KAPAP, having realised the extension service's limitations, provides common interest groups with grants of up to 3 million Kenyan Shillings per year to buy services such as extension, soil analysis or advice on marketing. Beneficiaries do not have to pay interest or repay any portion of the grant (Exp10). FCI acts as a financial broker between farmer groups and supermarkets, providing financial training on issues such as record keeping, savings mechanisms and insurance. They also work together with Kenyan financial institutions such as Equity Bank and other Savings and Credit Cooperative Organisations (SACCOs), managing a "pooled bank account" through which supermarkets can pay farmers, as well as acting as security for farmers so that they can gain access to finance (Exp18).

In summary, poor farmers face a similar situation with regard to access to inputs and finance as they do in the case of knowledge dissemination; in too many cases access depends on the availability of, and membership in, programmes provided by NGOs or other actors, rather than on a general, needs-based public subsidy available to the entire farming community.

INNOVATION BOX 4: A “merry-go-round” is an innovative farmer-to-farmer self-help solution for group or individual investments, usually carried out within organised farmer groups (e.g. CIGs). The group’s members together collect money in order to finance, for example, a member’s individual purchase of a new goat or a new tool for the whole group. Merry-go-rounds not only involve investing collectively, but also include sharing labour, helping on each other’s farms in turns or when a member is in special need (FGI8).

4.3 Actor linkages

This subchapter describes how the flows of information (mostly concerning research and knowledge dissemination) and of other resources described and analysed above are guided and structured by the actors’ formal and informal linkages and relations. For better analytical understanding, the study distinguishes different forms of linkages that influence the performance of innovation processes, namely influencing/agenda-setting, collaboration/cooperation, coordination and market linkages. Concrete interactions (as in activities carried out between actors), such as service provision, the selling/trading of a product or the dissemination of information, are usually affected by more than one of these actor linkages²⁷. The emphasis here will be on collaboration and coordination as the most important linkages for building an inclusive innovation ecology.

4.3.1 Influencing and agenda-setting

The influence and resources to set another actor’s agenda can be a powerful tool to change the direction of activities and therefore of innovation processes or even the entire innovation ecology. It can also create strong dependencies on other actors. Accordingly, the political economy of the actors involved has to be taken into account when setting up a specific innovation system.

Influencing and agenda-setting can range from power relationships, such as formal institutional hierarchies or informal authority exercised by elders, to specific

27 Market linkages between actors will not be considered separately here, as their performance regarding innovation usually relies on the way actors are linked beforehand, meaning the ways they collaborate in business or coordinate their activities to improve market positions and negotiating power (see Part II: 4.3.2). The market linkage itself is therefore regarded as only the product of a prior interactive process.

activities, such as private lobbying or donors setting a county's or institution's priorities, for instance in research. There are numerous examples in the Kenyan ALV innovation ecology showing the great influence some actors have on others, of which only a few specifically significant ones are examined here.

In terms of agenda-setting for research, the influence of donor and private funds and interests is substantial. Most donor and private funds still go to conventional agriculture. Because of the funds they provide, private sector lobby organisations such as ACCRA have, for example, been able to put GMO research on the official agenda (Exp1; Exp3; Exp7; Exp14). Due to the lack of direct government funding and a large influx of donor money, most large-scale university and KALRO research projects are also donor funded, their priorities often set far away in the donor country without real involvement and ownership on the part of Kenyan partners (see also Part II Chapter 3). The continuous donor dependency and private sector influence is lamented by many researchers, politicians and even donors (Exp5; Exp14). The same goes for the IARCs. Although their core funding comes from multilateral coffers, and although their mandate clearly targets the south and its development challenges, priorities are still mostly set in the north, and specific research projects are mostly funded bilaterally between a donor and an IARC (Exp5; Exp8).

In the ALV innovation ecology, donors have been financing a range of related research projects, though mostly short-term and in a rather uncoordinated fashion. They have often not built on previous research and have partly had competing priorities with many other research projects. It remains an open question whether less donor and private influence and more Kenyan priority setting would in fact be beneficial for ALVs.

Extension and dissemination activities are also heavily influenced by powerful, resource-rich actors, especially the private sector and donors. The private sector, especially multinationals, not only uses the media to promote its products, providing content that supposedly gives real "advice", it also does so directly with the farmers, creating the illusion of selflessly offering valuable information where government services have largely failed. Donors such as USAid buy airtime on prominent media programmes like *Shamba Shape Up* to broadcast their content (Exp24). NGOs' activities and therefore agendas are also largely donor dependent. The same goes for the public extension services. As government support is extremely limited, the few refreshment training and field activities that are offered are often donor funded (Exp27).

Another key area of influencing and agenda-setting that needs to be looked at is of course the policy arena. Many Kenyan agricultural policies are shaped under the influence and consultancy of donors and the pressure of the international community. In effect, economic priorities are trade liberalisation, commercialisation and export orientation (see Part II Chapter 2). Pro-poor crops like ALVs have little space in these discourses. In the policy arena itself, power relationships, conflicting and vested interests and priorities between government levels (national vs. county vs. local), institutions (between the administration and implementers such as KALRO) or even individuals, have a great influence on agenda setting. This affects research, extension and the political support for the promotion of crops like ALVs. These factors should always be considered for any specific innovation system.

4.3.2 Collaboration and coordination

According to the Innovation Systems Perspective, effective coordination and collaboration between the many diverse actors in their research, extension or other activities related to promotion and innovation in the ALV subsector are key to an inclusive, coherent and successful innovation ecology, and preconditions to a sustainable and possibly pro-poor impact. In the following, existing collaborations and coordinating mechanisms (or the lack thereof) will be examined by way of examples and according to their importance for ALV innovation.

Countless formal or informal collaborations between actors or individuals exist in Kenya. They usually serve a common purpose, such as farming together, research, information dissemination, accessing markets, policy design or curricula revision, and therefore serve very distinctive purposes within the innovation processes taking place. Many of them function well, some exist only because and as long as they are demanded and funded externally, while others exist only on paper in the form of policy documents and never reach the implementation stage. Farmers, for instance, cooperate with each other on a day-to-day basis in their CIGs or just as neighbours and family members. They do so mostly because together they are a stronger actor on the market, can share labour and need fewer inputs and machinery (Exp7). Their collaboration also helps them adopt innovations more quickly and on a potentially larger scale.

Research collaboration and coordination

For research purposes a wide range of actors collaborate on diverse issues in Kenya. Principal actors are the universities and KALRO, but companies such as Simlaw Seeds, IARCs such as AVRDC, NGOs such as ASARECA and parastatal

programmes such as KAPAP are also involved in a number of ALV-related research projects. Most interviewees asserted the importance of collaboration and involving actors according to the strengths that they can bring to a specific research topic, such as expert know-how or specific facilities such as laboratories (Exp1; Exp3). In the same way, interdisciplinarity can be enhanced, enabling more integrated research covering all important aspects, which no single researcher would be able to address. In practice, however, this type of collaboration is currently not common, according to Peter Okoth and other informants:

We are competing for the same resources. There is competition for space, recognition and budget share. Each institution has its own mandate. Researchers are busy publishing. We don't work together unless it is exactly the same topic (Exp25).

This assertion also raises the question of coordination of the many research projects across the country and beyond. Many researcher and other actors recognise the problem of research not building on what has been or is being done by others, nor considering the projects' own sustainability and post-project follow-up (Exp5; Exp7; Exp11). In fact, today there is still no central government coordination assessing and linking existing agricultural research and development programmes, coordinating priorities, storing knowledge and ensuring coherence. This results in many actors not being aware of much of the high-level research that has taken or is taking place, nor having access to the results (Exp5; Exp11; Exp30). The need for a more central coordinating body has been acknowledged within the ongoing restructuring of the NARS. KALRO envisages becoming the central node within the Kenyan research network. In addition to a knowledge management function, the KALRO College will also coordinate the pooling of research results from many institutions and accommodate desk officers for all major players in agriculture: universities, IARCs, some private sector actors and NGOs (see also Part II: 4.1.3 Knowledge management systems). In the future, the headquarters will also be tasked with coordinating all the KALRO institutes' activities on the regional level and with engaging stakeholders more centrally for intervention activities (Exp11).

On specific issues such as ALV seeds, many actors have, in their daily practice, been engaging in coordinated and collaborative research. However, unfavourable regulations, resource constraints and bureaucracy still too often undermine efforts. AVRDC (in Tanzania), for example, has problems bringing newly-bred seeds to Kenya as the regulatory government agency KEPHIS will not allow this (Exp4; Exp13) (see also Part III).

Besides external collaboration and coordination of research, internal communication and coordination within multi-stakeholder projects is another crucial issue that needs to be addressed, as work packages and sub-projects often depend on each other's progress and results. Research donors usually do not fund coordination activities within the projects or with partners and expect them to be carried out "on the side" (Exp1; Exp5). Donors underestimate the importance of, as well as the human and financial resources needed for, effective and sustained collaboration, communication and coordination.

Collaboration and coordination for information dissemination

There are numerous actors and media channels disseminating agricultural information and knowledge. The need for complementary services and more coordination, regulation and quality control of their activities in light of the ongoing crisis in the public extension services remains high. This has also already been acknowledged by the MOA and the extension service itself, with new extension guidelines and county coordinating forums apparently in the planning (Exp10; FGD1). The focus of the assessment here lies on some good examples of collaboration, but also some bottlenecks regarding pro-poor information dissemination, i.e. targeted dissemination that is geared towards poverty reduction.

Collaboration for information dissemination via outreach and training activities between researchers, the media or advisory services are manifold. Many of them do not have a clear focus on ALVs alone, but still provide a good example of what works and what does not. Good practice examples include the formalised public multi-actor media collaboration between universities such as JKUAT, KALRO, the MOA and the KBC (for TV and radio programmes), or between ICIPE and *The Organic Farmer Magazine* (Exp12; Exp13). Researchers provide content and expertise, while the media actors provide the channel for dissemination. Compared to mostly privately funded programmes such as *Shamba Shape Up*, these seem to be more fruitful public-public collaborations that allow space for less commercial and more farmer-oriented, pro-poor approach and content such as ALVs. There are also a lot of examples of researchers from universities, KALRO and IARCs working directly with NGOs and the extension services to disseminate their content and get in touch with farmers. While collaboration with NGOs is generally praised as a productive endeavour, the link between public research and extension is seen as insufficient. There is also no formalised mechanism for passing information from research to mid-level colleges to extension officers (Exp6; Exp12; Exp30). Problems usually come down to a lack of funding and staff both at the research institutions, but even more so at the public extension service. Collaboration with schools and

clinics is also seen as an area that could have a great impact, but would need to be substantially improved (Exp10). Often there are just not enough resources to collaborate sustainably in a coordinated fashion.

Again KALRO sees itself as the natural link between research institutions and advisory services / linking actors in the future (Exp11). Others see the universities as more important players for the coordination of research, knowledge management and dissemination activities (Exp3). In contrast, neither county nor national governments are seen as suitable actors for coordinating research and extension activities alone (Exp10). The aforementioned problems are of course not confined to ALVs but rather affect most agricultural knowledge dissemination. As under-utilised and politically under-prioritised crops, however, ALVs' chances of being promoted in an already weak collaboration framework are low. As seen in the chapter on past campaigns to promote ALVs (Part II Chapter 2), collaborative multi-actor campaigns with a clear aim, such as publicly promoting a specific crop for a certain period of time, can nonetheless yield substantial positive results. Concerted advocacy efforts do not only promote a product to the wider public, they can also go a long way in putting ALVs on the agenda of researchers, policy-makers and donors.

Another important aspect of collaboration in information transfer is the brokerage of contacts between actors. In particular, the public extension service helps other actors, including researchers, private companies and NGOs, reach their target groups, mostly the farmers. These groups frequently use public extension officers for community entry (FGD1). Extension officers, however, reported feeling used by them as a tool for their own purposes rather than as a true collaborator in improving the coverage of extension. While farmers often praised the NGOs' frequent trainings, extension officers and other experts expressed mistrust of private and non-governmental advisory services (Exp6):

[...] they always ride so much on our backs, the private extension providers. They'll come, ask for my groups, the groups I've trained, the common interest groups and they'll take off. Because they are funded, they have money, they will go to the groups, pay some tokens here and there so next time I'm going to the groups, I have nothing to give them, so they will not listen to me but initially I'm the one who formed the groups. So they ride on our backs (FGD1).

Other examples of contact brokering include NGOs such as Farm Concern International linking value chain actors, e.g. organised farmer groups or large-scale farmers to bulk purchasers and supermarkets (Exp18).

4.3.3 Innovation platforms as a way forward

This section points to ways forward as well as bottlenecks and further questions that result from the analysis. As shown in Part II Chapter 4, the political economy of research, information dissemination and intervention projects is a relevant factor that should always be considered. Private companies, and especially donors, still have a great influence not only on policy and research agendas, but also on which knowledge will ultimately be disseminated, and which programmes implemented. Donor-dependency was mentioned by many interviewees as a hindrance to Kenyan ownership and participation and also to the sustainability of many interventions. In terms of ALVs, the study also observed a large donor influence. However, the picture is ambiguous, as it is unclear whether less donor influence would actually mean more support for ALVs.

Here, the question of the functioning of existing collaborations as well as coordinating mechanisms (see Part II: 4.3.2 Collaboration and coordination) comes into play. For the most part, it is still inevitable that donor funding will play a major role, and such funding is sometimes even indispensable for priority setting and for the implementation of pro-poor programmes. Given this fact, how can Kenyan ownership be strengthened, or programmes be made more sustainable and inclusive as well as relevant and effective? Which existing collaborations and coordinating mechanisms can be built upon? Which linkages need to be strengthened or even newly created? The findings of the present study point to great opportunities within existing collaborations. These include farmer-to-farmer exchanges and self-help, as well as the numerous collaborative projects that employ a more coordinated and integrated approach in order to achieve more relevant, needs-based research and extension. There is also a host of already existing or planned coordinating mechanisms, actor networks and local and national innovation platforms (Exp5; Exp11; Exp32).

Some collaborative projects try from the outset to involve relevant partners and to think about farmers' needs and the dissemination and implementation of research results in order to bridge the information-implementation gap. KALRO has recognized the need for a better and more central coordination of research and implementation activities, as well as a central knowledge management system that pools research results and local knowledge from the many actors involved in agriculture research and practice. The national government recognizes the need for more coordination, regulation and quality control of the actors that disseminate knowledge.

Despite these positive developments, challenges for better coordination and collaboration, multi-level participation and more Kenyan ownership within the ALV innovation ecology remain difficult, and it remains to be seen whether planned reforms will be successful. Initiatives like the KALRO College are welcomed by many researchers, farmers, extension and NGO staff and policy-makers alike, as an attempt to address the many existing problems in a more holistic way. However, many are still unsure as to KALRO's suitability for the role of leading actor and the prospects for sustainability given KALRO's low level of funding. Kenyan institutions as well as donors are still too often unwilling to commit sufficient funds for coordination within and between institutions and actors.

Generally, however, the creation of a collective space and mechanism for innovation that links farmer-level innovation platforms to national-level platforms is seen as the (only) way forward for better collaboration and coordination that allows for the participation of all relevant actors, interactive learning, sharing of experiences and visions, and as pro-poor solutions.

5 Conclusion and recommendations

Based on the assessment of the functioning of the ALV innovation ecology and on the findings presented in Part I and Part II, this section presents the overall conclusions and recommendations. Particular emphasis is placed on how innovation processes can become pro-poor themselves so that innovations can have an ultimate pro-poor impact. Opportunities for innovation as well as recommendations for improving aspects of the ecology are also given throughout (💡). Identified needs for further research of the innovation ecology or in relation to specific issues regarding ALVs are also highlighted (🔍).

Furthermore, after having assessed a specific value chain problem using the example of ALV seed supply in Kenya, Part III identifies entry points for possible interventions to address seed supply problems.

The innovation ecology of The African leafy vegetables: Determinants, opportunities and challenges

The African leafy vegetable innovation ecology is characterised by great dynamism. Today, ALVs are perceived as healthy and truly Kenyan. As a result, their high nutritional value and the rising demand for ALVs represent great potentials for innovations along the entire value chain, underlining the need for large-scale multidisciplinary research, such as HORTINLEA, focusing exclusively on the otherwise neglected ALVs.



The extent of the generally proposed pro-poor potential of ALVs, realised through innovations that upscale production, value-addition and marketing, should be a focus of further deep research.

Socio-economic context factors

As mentioned above, socio-economic context factors, such as the distribution of and access to resources and infrastructure, greatly determine actors' capacity to innovate.



In order to improve the participation of different actors in ALV innovation processes – including subsistence farmers, women and youth – and to create a more inclusive innovation ecology, the ALV-related structural socio-economic problems should be addressed on all levels, from national development goals down to local level policies and programmes.

The study realised that the widespread unequal distribution and scarcity of agricultural land, being a key resource, is for many farmers, especially women and youth, a hindrance to innovating, or even to moving into the ALV subsector at all. Access to other key resources and infrastructure such as finance and roads is also very limited, particularly for the poor and remote farmers.

Institutional and policy framework

The institutional and policy framework in which the ALV innovation ecology is embedded still falls short of its overall objective of promoting food and nutritional security and poverty reduction. In effect, it almost exclusively promotes large-scale commercialisation of high-value crops that are predominantly export-oriented, leaving little space for targeted support of the poor and little serious attention to the potentials of underutilised crops such as ALVs.



There is a need to shift from well-intentioned policy-making to actual pro-poor programming, taking account of the potentials of ALV production to address food security challenges and targeting also small-scale farmers.

It also remains to be seen whether the current process of devolution will have a positive impact on more targeted pro-poor programming.

ALV value chains

The study identified a two-dimensional differentiation within the sector that needs to be taken into account, the first being the level of commercialisation of the two value chains and their actors, and the second being regional differences among production sites.



Address the problems of the ALV innovation ecology separately by value chain and regional differentiation.

Although almost all ALV farming is done by small-scale farmers, the study discerns differences in ALV value chains according to their economic orientation. One value chain is characterised by a well advanced commercialisation of production and marketing, with farmers often living closer to urban centres and formalised markets and marketing most of their produce. The other value chain is predominantly rural and marked by subsistence farming, where only little surplus is sold irregularly on the local informal markets. Value chain problems, which this study understands as opportunities for innovation, therefore differ between the separate value chains.

In Western Kenya, the study found mainly subsistence farming due to a lack of markets, transportation and arable land. Here, ALVs are still deeply rooted in the local cultures.



Integrate local knowledge on ALVs, which represents a great potential for innovations in research and development activities. Demand-driven research has to assess farmers' needs and incorporate farmers, their indigenous knowledge, solutions and feedback into the entire research process.

The greater market orientation and larger-scale production of the farmers closer to urban centres, found mostly in the central Kenyan study region, may mean that commercial farmers are generally more innovative, or willing and able

to innovate. This hypothesis, however, cannot yet be confirmed by the study and represents a need for further investigation.



Analyse factors affecting farmers' willingness or ability to innovate or adapt new solutions, according to their level of commercialisation.

Actors

While the social and political environment is a strong determinant for many aspects of the innovation process, innovations themselves must still be carried out by the actors. Eventually, their capacities to innovate determine the success or failure of the interactive process of innovation.

The policy arena: The national government's potentials in regard to ALV innovation processes are their financial and human resources, and their power to influence other actors and Kenyan politics in general. Hindrances may include their failure to support subsistence farmers' food and nutritional security and underutilised crops, despite having the resources to do so. The county governments' potential is their proximity to farmers; a major hindrance is their lack of resources. In regions with a high potential for ALVs, important successes in ALV research and their promotion have been achieved, but have not yet been coordinated and supported by the national government.

Civil society actors are an important part of the innovation ecology due to their advocacy capacities in regard to policy changes and the implementation of ALV innovations.



Cooperation between innovation ecology actors, including HORTINLEA, and civil society actors should be intensified. The pro-poor target group orientation of civil society actors directly working at the farmer level should be seen as a large networking and collaboration potential.

The research system: The agricultural research institutions in Kenya comprise several systems with different missions, and different capacities for research and for outreach to farmers, namely the National Agricultural Research System (NARS),

the International Agricultural Research Centres (IARCs) and the national universities and their international collaborations such as HORTINLEA.



Because of its function, human and financial resources, and its adequate geographical spread, KALRO is one of the best placed Kenyan institutions to promote the application of research findings and innovations on a national and regional scale. Its potential should therefore be thoroughly explored.

KALRO is quite well linked with commercial agriculture and international donor organisations. However, the links between KALRO research and subsistence farmers are rather weak, and ALVs are not yet a priority on the KALRO research agenda.

International agricultural research centres, though potentially very powerful players in research, extension and advice provision, have surprisingly little networking and collaboration potential, especially in regard to linking with and getting feedback from farmers.

The most sustainable potential of the universities regarding ALV innovation processes is their role in educating future agricultural professionals. Universities may become an important pillar in involving the youth in ALV innovations. They also advance two-way approaches to extension and work closely with farmers. Tight budgets and little institutionalised interest for ALV research may reduce the impact of the dedicated ALV research and extension efforts of individual professors.

Education actors: The education system is constituted of (1) universities; (2) middle-level agricultural training colleges that train future agricultural professionals including extension officers; (3) agricultural training centres that train farmers; and (4) schools. The agricultural training centres and Bukura College additionally play an important role in sustainably incorporating ALVs into extension officers' and farmers' training and in linking research to practice. Although the education institutions cover all of Kenya, they only reach a limited number of farmers, due to their lack of human and financial resources.



Embed ALVs into the curricula of the education system. This has been initiated in some universities but has not been up-scaled by the national government.

Development agencies: Donors are valued as important partners at all levels. However, they face the drawback of supporting selective rather than long-term interventions, and the interventions are often donor- instead of demand-driven. ALVs have not yet been incorporated into many donors' agendas.

The development agencies / donors, the national government and the abundant high-level international research present in Kenya seem so far less interested in ALVs. They are, however, very influential in terms of the power they can exert to support ALVs in general and pro-poor innovations in particular.



Development agencies / donors, the national government and international research actors need to be sensitised, lobbied and incorporated more in order to make use of their capacities.

Value chain actors: A variety of value chain actors participate in the ALV innovation ecology. Different advisory services, channels of information and transfer of resources are useful to different value chain actors, depending whether they participate in a value chain connecting largely subsistence farmers with occasional surpluses, via middlemen, to smaller, local, markets, or in a value chain connecting commercial farmers directly with wholesalers or market vendors on bigger markets. Markets can also be differentiated into informal markets largely accessible to both subsistence and more commercialised farmers, and more formalised markets with higher quality standards and levels of commercialisation. Farmers are perhaps the most important actor group, being the target group of most innovations and development interventions. At the same time, they are active innovators, key to the success of each step of the innovation cycle, from research to adoption. ALV farmers' input-, production- and marketing problems differ, as do their access to information via different channels. They face the greatest challenges

with regard to their ability to participate, but if they cannot do so then the entire ecology is threatened.



Farmers are active innovators, key for the success of each step of the innovation cycle, from research to adoption. It is they who need to be strengthened and empowered the most to create a truly inclusive and successful pro-poor innovation ecology.

Farmers are not a homogeneous group, and cannot be supported by one-solution-fits-all interventions. Subsistence farmers innovate on different levels, for different purposes, different markets and with different resources, than do commercial farmers. Commercial farmers are more likely to have access to a variety of input suppliers and sources of information and advice, while subsistence farmers rely on what is there at the local level, mostly from Agrovets and other farmers.



While the private sector is viewed by many very critically because of its vested interests and large influence in policy making and programming, some private sector actors nonetheless must be considered potential partners for various tasks within the innovation process, from input supply to disseminating quality information.

Somewhat neglected and forgotten actors, such as Agrovets, can potentially play a larger role in disseminating innovative knowledge if they are trained, controlled and incentivised well.



A possibly larger and more active role for financial institutions needs further investigation, especially micro-finance and cooperative banks.

Linking actors: Linking actors, including the public extension service and local NGOs, are key actors for the promotion and support of ALV innovations among the farming population. The high legitimacy and experience of the governmental extension service make it suitable as a linking actor for knowledge exchange and innovation transfer from research to practice and vice versa. This potential is severely diminished by a lack of human, financial and physical resources.



Only the inclusion of linking actors will make it possible to implement broadly target-group-oriented, pro-poor strategies working directly with remote and poor farmers, ensuring their participation in innovation processes. These actors need to be strengthened the most in terms of their financial resources and human capacities in order to close the information-implementation gap between research and farmers.

NGOs may be as important a linking actor between farmers, research and markets as the extension officers. For information about marketing issues they probably exceed extension officers' abilities. Their experience with ALVs, their pro-poor target group orientation and extensive collaborative or social resources are all strengths. Drawbacks for ALV innovation processes are NGOs' dependency on short-term external funding and little (national) quality control of their work.

Interactions

In contrast to earlier approaches in R&D, the Innovation Systems Perspective goes a step further in emphasizing the importance of putting research results into use. Only when it is implemented does an invention become an innovation. This perspective therefore views innovation as a fundamentally social process in which actors have interactions, form linkages and maintain relationships. The study has reviewed and assessed three different aspects of interactions that are key to any innovation process: the transfer of knowledge for innovation; access to specific resources needed to implement a new solution; and the linkages between actors, i.e. the coordination of innovation processes, including the ways in which they collaborate and influence each other. These interactions and linkages were assessed with regard to their functioning within the innovation ecology as well as their inherent potential to support or hinder pro-poor innovation.

Transfer of information and resources: The study views information transfer as key to innovations in the ALV subsector, since most ALV innovations are knowledge-intensive and need few inputs. The study finds that direct face-to-face transfer of information is still the most important, targeted, adapted, sustainable and effective way of transferring information to farmers. Direct transfer also allows for mutual exchange between actors, direct feedback and continuous follow-up, and helps build the trust necessary for risk-averse actors to participate in innovation processes. Direct training of farmers, however, comes with a number of preconditions that remain challenges in Kenya. Trainings need to be conducted frequently, be free of charge and reach all farmers even in remote areas. As extension services and NGOs unfortunately do not cover the entire farming population, the media are still a necessary complementary way of disseminating information, though they are not able to replace direct transfer and pose other challenges such as quality control. The radio is the most affordable, most easily available and most understandable media channel for poor and often illiterate farmers. Therefore, the radio is the most important for pro-poor dissemination in comparison to other channels.



For a targeted dissemination strategy it is important to choose the right communication channel and language in order to ensure affordability, access and usability for the target groups.

Information quality: Of equal importance to the way information is transferred is the quality of the content disseminated itself. While the research community has reconsidered its approach and strives to make research and dissemination more demand-driven, the needs of farmers and other target groups still need to be taken more seriously. This also applies to the way their capacities, such as local knowledge and existing innovations, are taken into account. The feedback of target groups must be heard and incorporated so that the solutions proposed to them become more relevant and ultimately successful.



Rigorous quality control and management of the knowledge and information transferred must be ensured more centrally and between all actors. Actors that disseminate knowledge, whether public, NGOs or private, need to be regulated in a transparent way, ensuring that they follow national and local development and policy priorities.

The provision of resources to farmers (e.g. inputs or other subsidies) by public or non-governmental actors in order to support specific pro-poor innovation processes struggles with similar challenges to those faced in the transfer of information. Access to free or subsidised resources for poor farmers is still dependent on whether farmers are lucky enough to have access to or be part of an NGO or public programme, which is very rarely the case in Kenya. Broadly available and needs-based support mechanisms for the entire farming population are not present in Kenya, presumably due to a lack of funding and political will.



Only solutions relevant to and adoptable by (poor) farmers will become successful pro-poor innovations. In order to ensure the right knowledge reaches the right people the shift in research and information transfer must be accompanied by well-coordinated and freely accessible knowledge management systems, and a rigorous quality-control of the knowledge and information transferred.

Actor linkages: Every innovation process is affected by its political economy, meaning the power relations and influence between the actors involved. The study observed an especially large donor-dependency in setting the agenda for policies and research, which is seen by many as a hindrance to Kenyan ownership and participation as well as to the sustainability of programmes. It is unclear, however, whether less donor influence would mean more support for ALVs or pro-poor prioritisation or whether it would actually have the opposite effect.

In terms of existing coordination mechanisms, collaborations and networks the study closes on a cautious, but positive note. In particular, the many existing collaborative arrangements between researchers, farmers, media actors, policy

makers and linking actors point in the right direction of achieving more integrated and participatory innovation systems.

Within the Kenyan context, KALRO and the national government have recognised the need for more and improved coordination and collaboration among all the actors involved. They also see the need for better quality-control and regulation of the entire innovation ecology, including research, transfer of information and resources, development interventions and private sector activities.



To avoid creating parallel innovation platforms, the planned KALRO College should be considered as an important entry point for actors such as HORTINLEA to support Kenyan structures sustainably and strengthen the overall agricultural innovation ecology. In addition, they could push for more pro-poor programming and support for underutilised but highly important crops such as ALVs.

KALRO, with its institutes and partners across the country as well as the planned KALRO College, could become a major innovation platform in this regard. To succeed, KALRO College needs funds and human resources from the national government, as its task reaches from the national to the local level.



It is strongly recommended to actors involved in the ALV innovation ecology, such as HORTINLEA and its subprojects, that they use the Innovation Systems Perspective to optimise the innovation processes they wish to support and participate in.

In summary, the conclusion of the findings from the study's four main research areas gives an insight into the functioning of the ALV innovation ecology in Kenya.

Part III: The application of the Innovation System Perspective

The Innovation System of Seed Supply

Recalling the conceptual framework of this study, within the general innovation ecology of the Kenyan ALV subsector, a problem-based innovation system consists of a set of context factors, actors and interactions. Through a focused analysis of which factors affect innovation in a particular case and which actors have to work together better to solve the problem, the problem-focused innovation system enables the solution. Hence, once researchers have identified a problem in the value chain as an innovation opportunity (cf. Part II: 2.2 Problems along the value chain), they can construct for it a problem-based innovation system.

Steps to be taken in this framework are:

1. Describing the problem situation and innovation opportunity
2. Identifying the relevant context factors and actors
3. Analysing their interactions and linkages to identify current bottlenecks
4. Concluding from the analysis which steps need to be taken to enable better interaction of actors to innovate effectively

NB: The analysis has to be guided by a clear idea of the target group (e.g. poor farmers).

This process helps to plan interventions in a more targeted way and to implement a given innovation sustainably within the value chain. In the following, the study demonstrates step by step how to apply the Innovation Systems Perspective to a specific value chain problem, using the example of seed supply.

Status quo and problem description

Smallholder ALV farmers in Kenya mostly acquire seeds from village markets, from local Agroveter shops or produce their own. Occasionally, they are supplied with seeds by NGOs and research institutions. In addition, they purchase certified seeds from seed company shops directly (this mostly applies to those identified in this study as commercialised). There is a range of complaints about currently available seeds: low germination rates, plants blooming before the leaves mature, lack of seeds for traditionally grown varieties and high prices for certified seeds. These issues negatively affect the ability of ALV farmers to adapt their production effectively to existing market demands (Exp4; InnovRT; FGD2).

Therefore, the core problem for ALV seeds is the availability of the right seeds to producers. There are three dimensions to the problem, one relating to the inherent quality of the seeds themselves, the second to their adequacy in different locations and the third relating to the logistics of availability. Ideally, seeds should be of a high quality, as measured by their germination rate and the quality of the plants they produce. At the same time, they should be adapted to cultural preferences and ecological conditions in the regions where they are used. Very importantly, they should be available at affordable prices, in constant supply and in any location that has a demand for them.

To sum up, the aim of a problem-based innovation for ALV seeds is to adapt the context in such a way that all relevant actors are able to work together effectively towards the final goal of providing high-quality adapted seeds wherever they are needed at an affordable price. This last aspect is especially important if the innovation system for seeds is in addition intended to have a pro-poor impact.

Identification of context factors

In the current regulatory context in Kenya, certification of a new variety of seeds takes three to five years (Exp4). The key institution is the Kenya Plant Health Inspectorate (KEPHIS), which holds full control over which seeds can legally be sold. NGOs criticize that under the Seeds and Plant Varieties Act (1991, last amendment in force since 2013) farmers are practically forbidden to produce their own seed without KEPHIS' approval (Exp33). In addition, land used for seed multiplication is limited in Kenya, allegedly due to governmental mismanagement (Exp13). Consequently, there is a heated debate between the government and its critics over seed development. However, NGOs recommend that researchers "get around the Seeds Act" by declaring the seeds they distribute "planting material" instead (Exp33).

Identification and description of actors

On the research side, The World Vegetable Centre (formally: Asian Vegetable Research and Development Centre, AVRDC) plays the role of a regional developer of new seed varieties. These are made available to KALRO (including its different regional centres that focus on ALVs) for further experimentation, as well as to university researchers who are working on developing improved varieties (Exp8; Exp11). University researchers also work on developing new varieties.

The only nation-wide multiplier and distributor of certified seeds remains the national public enterprise Simlaw Seeds, as other private seed companies do not seem to see the economic potential in producing and selling high-quality, adapted

ALV seeds. Simlaw Seeds' licensed agents are only a smaller part of the network of distributors of agricultural inputs, the biggest part of which is made up of local Agrovet stores that are especially present in rural areas (FGI10). Local Agrovet stores, however, often do not sell certified ALV seeds or are unable to provide the necessary advice on their use.

Development NGOs, such as Farm Concern International (FCI) and Rural Outreach Programme (ROP), act as distributors of subsidised or entirely free seeds to those farmers they target with their interventions. Although farmers praise the quality of these seeds, the geographical and time limitations of programmes mean that NGOs cannot permanently act as seed suppliers (FGI10).

ALV farmers informally multiply seeds, and some of them sell seeds on local markets or exchange them with their peers. In the latter case, they rely on more or less informal seed banks (some of which are run by NGOs), as they would rather "borrow" seeds from one another than buy expensive seeds (Exp13).

Analysis of interactions

This analysis identifies three dimensions of interaction between the actors identified above:

1. Coordination of seed supply / dissemination

Simlaw Seeds offers certified seeds for the main ALV varieties but sells mostly to more commercialised farmers from its own distribution agents. This might be due to package sizes and prices that are not adapted to subsistence production. In addition, the company has a network of stockists, who compete with the regular Agrovet stores found in small towns in Kenya. Many of these, even in Western Kenya, do not sell ALV seeds at all or do not specialise in them, as they do not see them as profitable. As a consequence, not all farmers can afford seeds adapted to their needs or even to travel to the shops that would sell them. In remote locations, farmer-to-farmer exchange and informal markets provide seeds from informal reproduction, but coordination with agents is not easily possible.

Research institutions such as KALRO Kakamega supply farmers in their vicinity, at subsidised prices, with seeds that are produced in the research process. However, this offer is not part of the regular ALV seed market and is therefore not reliable for farmers. The study found that it is limited to those well-informed farmers who are able to travel to the research station to collect the material or who can afford to have it delivered. NGOs that promote ALVs occasionally provide seeds directly to farmers, but the same limitations apply that make distribution of sur-

plus seeds from research unsustainable: they have a limited geographic reach and are not in place permanently.

Some farmers reported a lack of coordination among providers of seeds on the content of information provided along with them (e.g. on germination times) (FGI10). This might be due to mistrust between the private sector and NGOs, and negative mutual perceptions of their respective modes of operation (InnovRT). Mistrust also stems from non-transparent responsibilities; when farmers perceive seed adulterations in the material they get, they tend to blame their distributors. Distributors in turn blame researchers or breeders (InnovRT).

II. Flows of information

Actors in the innovation system for ALV seeds communicate about various things. Seed producers assess the users' needs, farmers tell each other about their innovations regarding seed reproduction, etc. Well-connected individual researchers get feedback through personal channels about farmers' success or failure with the provided seeds (Exp3; Exp7). In addition, AVRDC encourages farmers to grow their own, open pollinated seeds that can be reused (Exp8). KALRO works with NGOs to encourage experimentation with seed material among farmers (Exp34). The needs assessment and feedback taking place between researchers and farmers is potentially accessible to poorer subsistence farmers who show interest in the subsidised material provided. However, due to the limited reach of research institutions, communication includes only those farmers lucky enough to live within their vicinity.

Simlaw Seeds is a gatekeeper for the identification of needs for new or improved varieties when it comes to commercial farmers, as they will adapt their range according to the market potential they perceive. The company's main feedback mechanism is the demand for their products. For example, when the company receives frequent requests for a variety they do not yet sell, they consider expanding their range. To make such requests, or to make complaints, farmers call distribution agents directly or come to the stores. However, as mentioned, this applies mostly to the more commercial, peri-urban farmers who can afford to undertake an additional journey and who have had the chance to establish a personal contact with a distribution agent.

III. Cooperation of seed developers and producers

The process from the identification of the need to create a new variety, through experimentation, breeding, certification, multiplication and distribution involves primarily research institutions and the producer Simlaw Seeds. Their ability to co-

operate effectively is crucial. In this formal sector, Simlaw Seeds will effectively choose which new varieties they can produce and distribute, while the range that the company chooses from is determined by the research institutions.

Simlaw Seeds obtains seeds for new and improved varieties from AVRDC, which they then take through the certification process with KEPHIS and subsequently multiply to sell (Exp₄). To some extent, Simlaw Seeds also collaborates with universities, but some of their past collaborations did not succeed in actually bringing new improved varieties of seed to the market, due to a lack of formal agreements (Exp₄). Here it is possible that the interests of the two sides were not aligned, as the universities did not have the same focus as the company on achieving wide distribution through commercialisation.

MAIN FINDINGS AND STEPS FORWARD

Having assessed the most important aspects of the innovation system for ALV seeds, it is possible to draw some conclusions and identify entry points for interventions. On the level of context factors, especially concerning the regulatory framework, a balance has to be found between standardisation and quality control on the one hand, and strengthening pro-poor, farmer-driven innovations on the other. As shown above, the current regulations are directed towards central control, which means that the potential of farmers and researchers to work together is not fully realised. Therefore, the framework should be adapted to enable all relevant actors to work together in a decentralised way.

Concerning key actors, the capacities of research institutions for the production and distribution of seeds should be strengthened. Currently, they make seeds from the research process available on an ad-hoc basis to farmers in their surrounding areas.

This potential could be enhanced if seed supply became a regular responsibility of research institutions, one that was sufficiently funded and coordinated with other suppliers of seeds.

As described in detail above, the private sector is not currently involved in the ALV seed supply. For the market segment of high quality certified seed, the parastatal company acts as a monopolist. There is a potential to attract private sector companies to produce ALV seeds, but the pro-poor aim of interventions should be kept in mind. It is conceivable to incentivise other private seed companies to cater to the needs of commercialised ALV farmers while Simlaw Seeds receives stronger support to target subsistence farmers, e.g. through subsidised small seed packages and information on their use in low-technology conditions.

To improve interactions in the innovation system for ALV seeds, there are a number of general recommendations. Greater trust has to be created through more transparent responsibilities in the process of seed development and distribution. Better feedback mechanisms on seed quality and the need for adapted varieties have to be created. More effective cooperation between developers and producers of seeds has to be enabled, possibly by making ALV seeds an interesting product for a greater range of producers.

As a further step, it is suggested to create an innovation platform for seed needs and seed supply, in order to cover some of above presented points collectively. Key actors could get together on a regular basis to exchange information about their work and coordinate for mutual benefit. On the one hand, this would take place at the local level around decentralised seed banks and involve primarily farmers as well as researchers on occasion. On the national level, there would be meetings of researchers and seed producers, as well as NGOs geared to ensure comprehensive availability of adapted seeds in all areas by coordinating supply. Exchanging experiences on needs assessment, national stakeholders could also optimise their methods of consulting with seed users.

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Annex

Annex 1: List of Expert interviews

Date ²⁸	Name of interviewee	Position and Organisation	Reference
BERLIN			
24.07.	Prof. Wolfgang Bokelmann	Head of Department - Agricultural Economics, Albrecht Daniel Thaer-Institute of Agricultural and Horticultural Sciences, Faculty of Life Sciences, Humboldt-Universität zu Berlin	Exp1
24.07.	Dr. Christoph Spurk	Project Leader, Zurich University of Applied Sciences (ZHAW)	Exp2
NAIROBI			
06.08.	Dr. Patrick Maundu	Head of the Kenya Resource Centre for Indigenous Knowledge (KENRIK), National Museums of Kenya	Exp3
11.08.	Christine Murungi	Distributor, Simlaw Seeds Company	Exp4
13.08.	Felix Zeiske	CIM-Expert, ITTACC Project, / International Centre for Insect Physiology and Ecology (ICIPE)	Exp5
13.08.	Dr. David Kagima	Director of Extension, Research and Development Department, JKUAT	Exp6
13.08.	Prof. Mary Abukutsa-Onyango	Professor of Horticulture at Jomo Kenyatta University of Agriculture and Technology (JKUAT)	Exp7
11.09.	PhD Fekadu Fufa Dinssa	Vegetable Breeder, The World Vegetable Centre (AVRDC) - Tanzania	Exp8
16.09.	Tom Apina	Regional Executive Director, SUSTAINET East Africa	Exp9
17.09.	Francis K. Muthami	National Coordinator, Kenya Agricultural Productivity and Agribusiness Project (KAPAP)	Exp10
17.09.	Dr. Wasilwa Lusike	Manager Horticulture and Industrial Crops, Kenya Agricultural and Livestock Research Organisation (KALRO)	Exp11
18.09.	Josephine Waretu	TV Producer, Kenya Broadcasting Corporation (KBC)	Exp12

²⁸ All interviews were conducted in the year 2014.

18.09.	Peter Kamau	Editor of <i>The Organic Farmer Magazine</i> , Bio-vision Kenya	Exp13
18.09.	Wanjiru Kamau	Employee - The Kenya Organic Agricultural Network (KOAN)	Exp14
19.09.	Boniface Akuku	Information Management and Communication Technology Assistant Director at KALRO (eRAILS)	Exp15
19.09.	Pamela Mburia	Executive Director at Kilimo Media International (KiMI)	Exp16
19.09.	Dr. Charles Waturu Nderito	Director of Horticulture Crops Research Institute, KALRO	Exp17
23.09.	Thomas Kariuki	Market and Trade Officer, Farm Concern International (FCI)	Exp18
23.09.	Patrick Mukono	Fresh Produce Coordinator, UCHUMI Supermarkets Limited in Kenya	Exp19
29.09.	Eunice Motemi	Free HIV-Advisor in Kenya	Exp20
30.09.	J. Ngugi Mutura	Executive Director, Sustainable Agriculture and Community Development Programme (SACDEP)	Exp21
01.10.	Anonymous	Extension Policy Officer, Ministry of Agriculture Kenya (MOA)	Exp22
01.10.	Dr Johnson Irungu Waithaka	Director of Agriculture, Crops Management, MOA	Exp23
02.10.	David Campbell	Founder and Director of Media for Education and Development Kenya - Media organisation, Implementer of <i>Shamba Shape Up</i> TV-series	Exp24
07.10.	Peter Okoth	Free consulting soil scientist	Exp25
KIAMBU			
16.09.	Wanjau Wangige	Employee – Agrovat, Kiambu County	Exp26
KAKAMEGA			
27.08.	Musanga Flora Akanwa	District Agricultural Officer, Sub-County Kakamega, Ministry of Agriculture Kenya (MOA)	Exp27
27.08.	Wachiye, Batha	County Horticultural Officer Kakamega, Ministry of Agriculture Kenya	Exp28
27.08.	Metrine N. Muricho	County Home Economics Officer Kakamega (MOA)	Exp29
21.08.	Dr. John Suge	Head of the Department of Agriculture and Animal Sciences, Bukura Agricultural College	Exp30
22.08.	Peter Wolanski	Advisor, GIZ – Food Security and Drought Resilience Programme, Siaya County	Exp31

28.08.	Remco Mur	Senior Advisor, Royal Tropical Institute (RTI), KIT-Sustainable Economic Development	Exp32
01.09.	Doris A. Anjawa (the following ROP staff members were also present: Violet Chunguli, Arthur Naman, Emmanuel Eshitemi, Vincent Lwegado and Rose-libah Awinua)	Field Coordinator, Rural Outreach Programme / ROP-Africa	Exp33
03.09.	Dr. Christine Ndinya-Omboko	Kenya Agricultural and Livestock Research Organisation, KALRO-Kakamega	Exp34
05.09.	Boniface Tumaini	Employee - Agrovat, Kakamega County	Exp35
05.09.	Godrick Khisa	Distributor - Agrovat, Kakamega County	Exp36

Annex 2: Semi-structured standard questionnaire

Interviewee: _____
 Institution: _____
 Position: _____
 Contact information: _____
 Interviewer: _____
 Documentation: _____
 Date: _____
 Place: _____

Key stakeholder groups:

- **PM:** Policy makers
- **R:** Research institutions
- **D:** Development actors: national and international development agencies and NGOs
- **PS:** Private sector: Seed companies, Supermarkets, Traders, Processors etc.
- **L:** Linking actors
 - **M:** Media
 - **E:** Extension services
 - **C:** Civil society organisations (including interest groups such as farmers' groups, lobby groups, advocacy organisations, churches)
- **V:** *Value Chain (local)*
 - **F:** *Farmers*
 - **T:** *Traders*

Introduction and study background

This study is part of the multi-stakeholder and transdisciplinary East-African-German research project HORTINLEA, commissioned and funded by the German government. We are conducting a study on the interaction and knowledge exchange of stakeholders in the horticultural system of African Leafy Vegetables (ALVs) in Kenya. We are interested in innovations that may take place along the entire ALVs value chain in general. Specifically, we look into the diffusion of knowledge and practices. We also look into the communication channels of various stakeholders directly or indirectly participating in the ALV value chain, such as policy makers, the private sector or agricultural research institutions. Finally, we are interested in relevant policies and institutions that determine the context of interactions.

A. Overview of stakeholder values, interests, activities and innovations

1. Please describe your organisation's vision, main areas of work and your personal role within the organisation (PM, R, D, PS, L)
 - How would you describe your organisation's approach to rural and agricultural development? (PM, R, D, PS, E, C)
 - What agricultural programmes do you implement yourself or are a partner of? Can you describe them? (PM, R, D, PS, L)
 - Can you describe your business model? (PS)

2. Do ALVs play a role in your work / business? Please describe why and how? (*What types of activities do / did you undertake?*) (PM, R, D, PS, L)
 - If not, why not?

3. Who is the target group of your programme, research, business / product and why did you choose them? (PM, R, D, PS, L)

4. Do you directly or indirectly work with the target group / farmers? (PM, R, D, PS, L)
 - Are they small scale, emergent or commercial?
 - How do you receive information about your target group's livelihoods, needs, demands and capabilities?
 - Do you interact with them in your work?

5. What major changes towards ALVs have you seen in the last 10 years? (PM, R, D, PS, L)
 - Were those specific changes or innovations organisational, technological, business or social processes (please give examples)? (PM, R, D, PS, L)

6. Why do you think these changes happened and who and what prompted and supported them? (Which developments favoured these, i.e. consumer demands / campaign / changed consumer habits / (pro-poor) political programmes) (PM, R, D, PS, L)

7. What kind of impacts did these changes have? Were they lasting? Have poor people benefited? (PM, R, D, PS, L)
 - If yes, which exactly and in what way have poor people benefited?
 - If no, why not? (Lacking access to knowledge, infrastructure, input (seed, fertilizer etc.), advisory services and other support)

8. Was your organisation involved in those changes and if so, what exactly was your role in the process? (PM, R, D, PS, L)
9. Which other actors were involved in the process of developing, disseminating or implementing new knowledge or practices and what role did they play? (PM, R, D, PS, L)

B. Stakeholders' resources and perception of interaction with others

Before going into more detail about the other stakeholders' participation in these change processes, we would like to talk about your regular interaction and communication with them.

1. Which other stakeholders (apart from your target groups / customers / colleagues / constituencies) do you normally cooperate with in your work and specifically regarding ALVs and why do you do so? (PM, R, D, PS, L)
2. How is your collaboration organised? (PM, R, D, PS, L)
(Networks, knowledge sharing platforms, market interactions, formalised collaboration, etc.)
3. How do you communicate with these actors? (PM, R, D, PS, L)
 - By what means? (email, meetings, telephone etc.)
 - Who initiates contact and how often do you communicate usually?
4. Please think of the organisation / institution / project you have the most productive exchange with. Could you think of reasons why this communication works well? (PM, R, D, PS, L)
5. Is there an actor who is particularly important / influential in the horticultural system and if yes, why is this case?
 - Do you communicate with this actor sufficiently?
 - If there are difficulties, what should be done better / differently to avoid / prevent problems? (PM, R, D, PS, L)
6. Returning to the specific changes concerning ALVs, who else is usually involved in such changes? (PM, R, D, PS, L)
 - Who took part in these changes and what was her/his function?
 - Who are the most important actors concerning these changes?

- Why are they important? How does the exchange work out in practice usually?
 - What is their main interest in working towards these changes?
 - What are their capacities?
 - Are they also the most powerful actors?
 - Were there any institutions or organisations which were not interested in participating in the change process? Were there any which actively opposed changes? Can you explain why?
7. What are your own institution's capacities and resources to participate in or improve the exchange of new agricultural knowledge and practices? (PM, R, D, PS, L)
 8. Are there incentives / benefits that would motivate your organisation to collaborate in improving the mutual exchange of new agricultural knowledge and practices? (PM, R, D, PS, L)

C. Dissemination and Diffusion Practices

After talking about the collaborative process of change, exchange of information and the development and implementation of innovations, we would like to ask more practically how you exchange and disseminate your knowledge to target groups/customers/audiences.

1. Do you have a dissemination / marketing / advocacy strategy for new products, research results, etc.? (PM, R, D, PS, L)
 - Through advertisement, radio, face to face, public campaigns, etc.
 - Through extension services? What role do they play?
 - Are these means of dissemination / marketing / communication successful?
 - Could they be improved? How?
2. Do you offer advisory services for farmers? What has been your experience by doing so? (PM, R, D, PS, L)
3. How can target groups / customers / audiences / communities get in touch with you? (PM, R, D, PS, L)
4. In your opinion, what are the hindrances in the dissemination and access of new knowledge and practices? (PM, R, D, PS, L)
 - In the system?
 - Particularly for farmers?

D. Social, Political and Institutional background

Here we are looking at how the policy and institutional framework and its major recent changes are affecting the horticultural sector and also determine its actors' capabilities to innovate.

1. Which (recent) policies and programmes and other government services affect the horticultural sector generally? (PM, R, D, PS, L)
(National policies, devolution process, international policies, etc.)
2. What do you think is the aim of these (horticultural / ALV) policies? (PM, R, D, PS, L)
3. Have they influenced your work generally and your research and programmes on ALVs particularly? (PM, R, D, PS, L)
4. What do you think about the devolution process currently taking place in Kenya? Does it favour or hinder the exchange of new agricultural practices and knowledge? (PM, R, D, PS, L)
5. What other social, cultural and political factors do you think might have an impact on the system? (PM, R, D, PS, L)
(Access to land (titles) and infrastructure, ethnic biases, bureaucracy, international trade requirements and policies, social inequality, corruption)
6. What is your take on the future of ALVs in Kenya?

E. Other comments/questions from the interview partners

1. Do you have any comments or questions?
2. What are your expectations from a study on the exchange of agricultural information?

Wrap-Up

Time interview ended

Interviewer's Name/Signature

Annex 3: List of Farmer Group Interviews (FGI)

Date ²⁹	Participant farmers	Location	Reference
KAKAMEGA			
21.08.	5 female and 5 male; average age: 40 (5<40 years, 5>40 years); Ifwetere organised cultural development group	Ifwetere, Malava, Kakamega County	FGI1
21.08.	10 male and 3 female; age range: 22-35; Bukhakunga Youth Bunge group	Kabras South, Malava, Kakamega County	FGI2
25.08.	11 mostly female; age range: 25-65; Bidii-yetu Self Help Group	Central Kakamega	FGI3
26.08.	12 female and 4 male; middle-aged (approx. 30-50)	Makutano, Kakamega Central	FGI4
26.08.	14 mostly female, middle-aged (approx. 30-50) from different organised women's groups: <ul style="list-style-type: none"> • Tumaini Women's Group • Ebuchira Farmers Self Help Group • Local Poultry Agribusiness Self Help Group • Isembe Fat Group 	Bukura, Kakamega County	FGI5
26.08.	5 male and 3 female; organised youth group; age range: 20-40 (3>40 years)	Kakamega Central-Nyayo Tea Zones	FGI6
04.09.	30 farmers; organised HIV group; mixed; average age: 20; age range: 25-50 (6<25 years, 4>65 years)	Navakholo, Kakamega County	FGI7
04.09.	8 male and 7 female; age range: 25-45	Kwishero Sub-County, Vihiga	FGI8
KIAMBU			
11.09.	Sospeter Mangua and Lucy Gichinga; Large-scale ALV farmers	Kihara, Kiambu County	FGI9
18.09.	11; mixed, middle-aged (approx. 30-50); organised group;	Kirenga, Lari Division, Kiambu West	FGI10
25.09.	14; mostly female; average age: 35-50	Githiga, Kiambu County	FGI11
NAIROBI			
17.09.	15; mostly female; Young "Ambassadors" Self Help Group – Agribusiness	Dandora suburb in Nairobi	FGI12

²⁹ Farmer group's interviews were conducted in the year 2014.

Annex 4: Guide for farmer group interviews

1) General information

Farming

1. What crops do you grow? Which vegetables do you grow?
2. Who grows these vegetables in your family?
3. What are the reasons for growing these vegetables?
4. What are your sources of food?
5. Whom do you ask when you want to improve your farming activities?
6. What are the best practices you employ to improve the production and marketing of your produce?

Marketing

1. Where/ to whom do you sell your produce?
2. Are the prices offered worth your efforts / inputs
3. What challenges do you face in marketing your produce?
4. Whom do you ask for information about markets?

Challenges in production

1. What are the challenges you face in the production process?
2. How do you solve these challenges?
3. Who helps you to solve these challenges?

2) Innovations / changes in production and marketing

1. Name the new techniques / innovative methods you have learnt / employed in production of ALVs?
2. Where did you learn them?
3. What are the changes you have observed over time in production, consumption and marketing of ALVs?
4. Why did you use them? How do they help you?

3) Information sources and exchange

1. Name the sources of information you use in production of ALVs
 - a. Specify: family and other farmers, farmer field schools, extension officers, media, NGO's, women's groups, etc.
 - b. Do you encounter problems with these sources of information? How can they be improved?
2. Name the type of information you get from the stated sources
 - a. The field of information (about farming, marketing, etc.)
 - b. Examples
3. Which additional information do you need? By whom?

4) Potential of ALVs

What opportunities do you see for the marketing of ALVs?

Wrap-Up

Annex 5: List of Focus Group Discussions (FGD)

Date ³⁰	Participants	Location	Reference
01.09.	12 extension officers from governmental extension service, MOA Kakamega	Kakamega County, KALRO	FGD1
03.09.	4 nutritionists from governmental departments of nutrition and home economics of the MOH and MOA	Kakamega County, MOA	FGD2

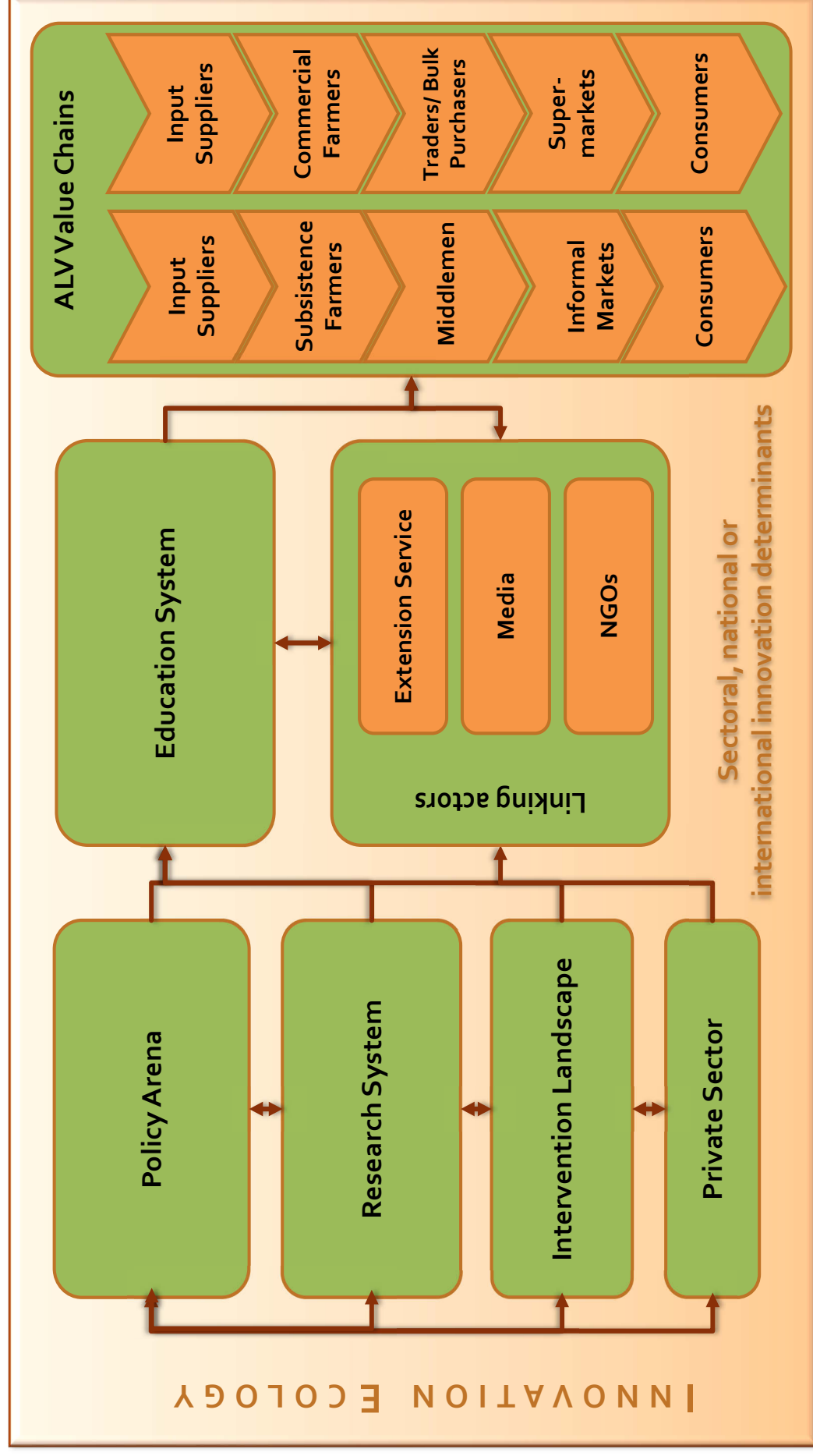
Annex 6: List of Stakeholder Meetings (StM)

Date ³¹	Participant(s), organisation(s)	Location	Reference
23.07.	German coordinators and researchers of HORTINLEA subprojects	Centre for Rural Development / SLE, Berlin	-
10.09.	<ul style="list-style-type: none"> Kenyan and German coordinators of HORTINLEA subprojects German and Kenyan development practitioners: SUSTAINET, KENRIK, ICIPE, GIZ. 	Kenyatta University, Nairobi (HORTINLEA Annual Meeting 2014)	InnovRT (Innovation roundtable)
30.10.	Kenyan stakeholders from research, NGOs, donors and policy-makers	KALRO Headquarters in Loresho, Nairobi (presentation of the study's findings)	-

³⁰ Focus group discussions were conducted in the year 2014.

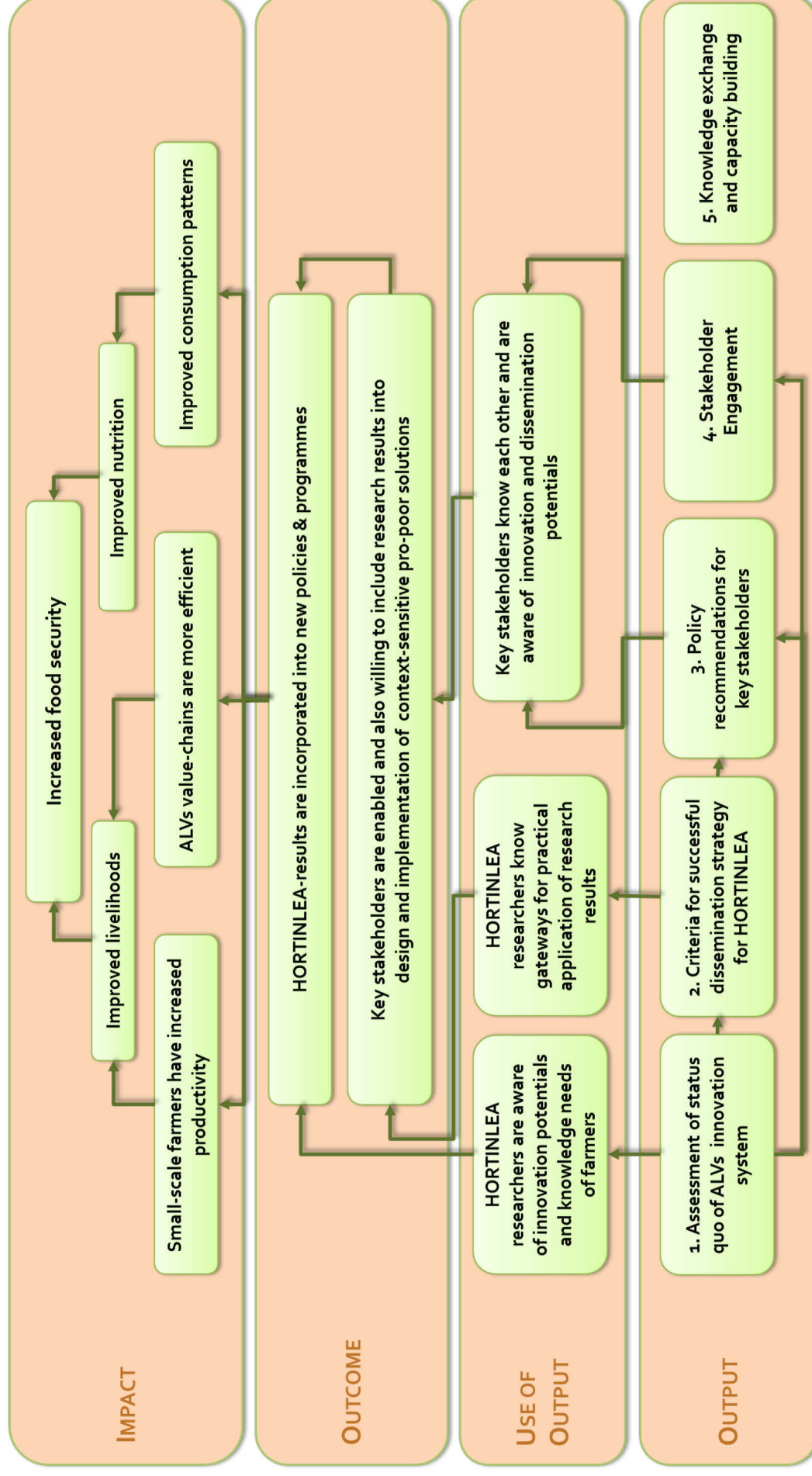
³¹ Stakeholder meetings were organised in the year 2014.

Annex 7: The Innovation System of ALVs in Kenya



Source: own illustration.

Annex 8: Impact Matrix



Source: own illustration.

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